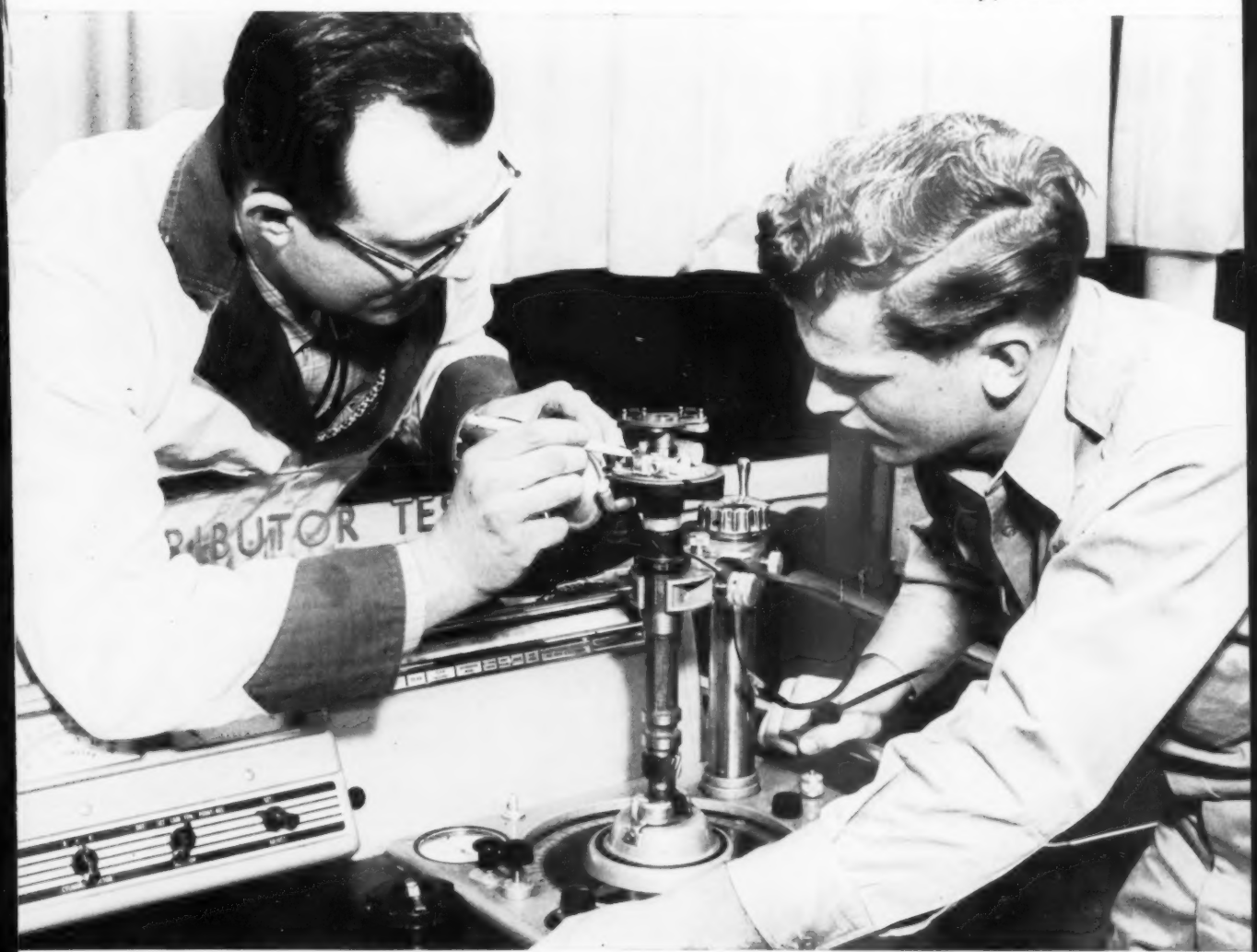
Automotive Service Digest

Our 46th year

July, 1958



Trade training for "those fitted"—See Page 12

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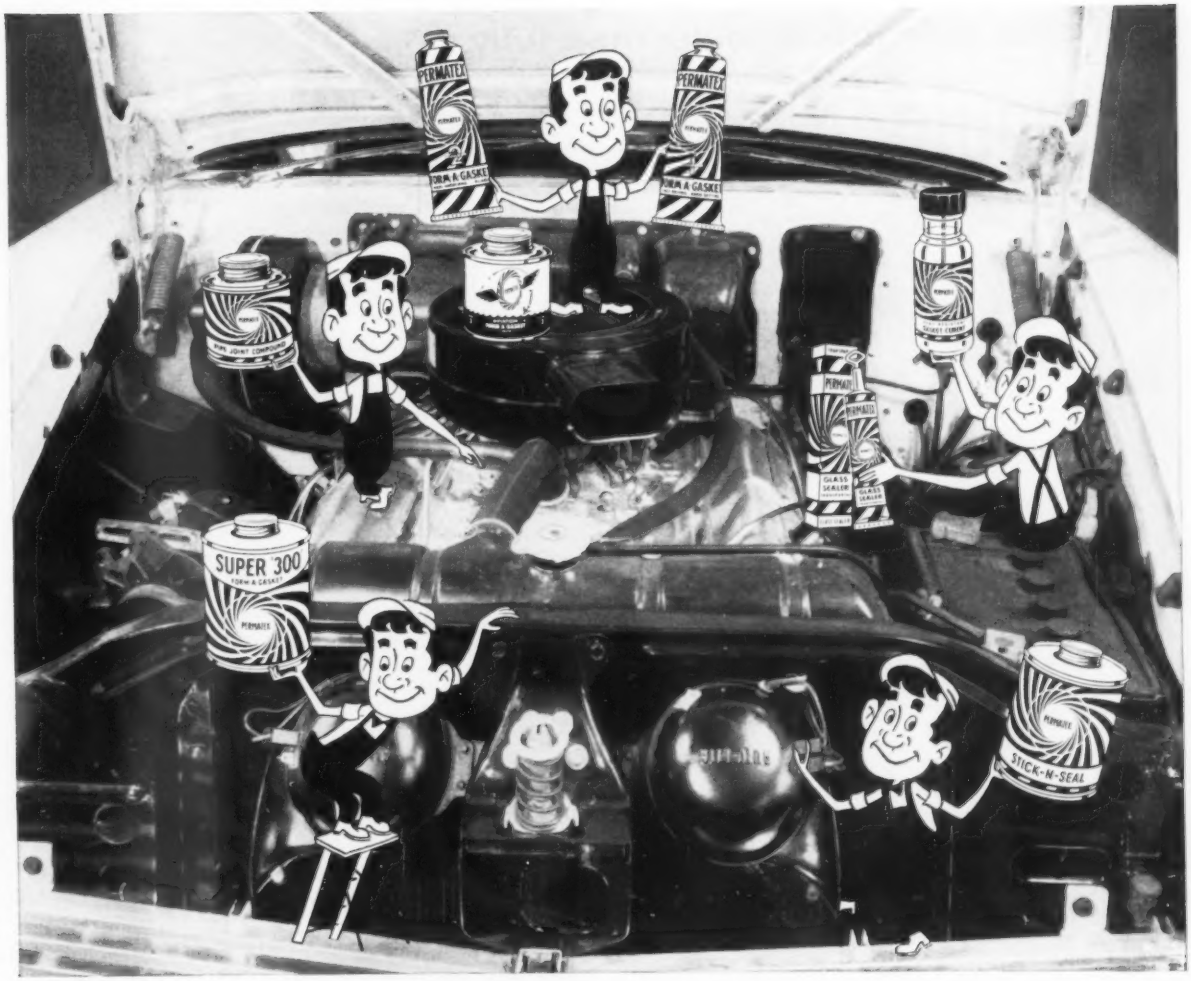

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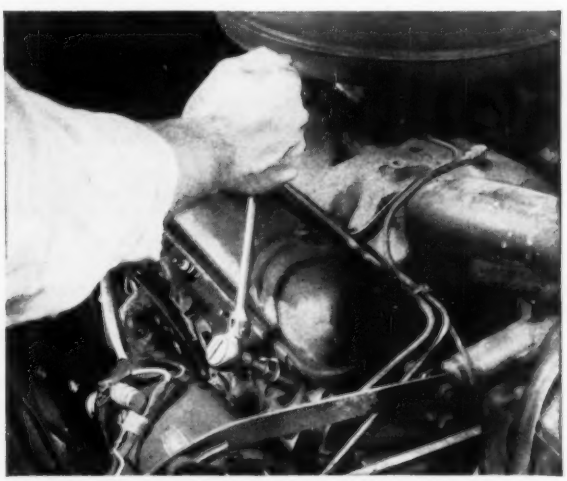
Mechanic tells jobber salesman why...

"I wouldn't give up my Champion

1. **"My Plug-Master was only $4.25** with an assortment of 50 Champion plugs," said the mechanic, "but I wouldn't sell it for $100, if I couldn't replace it. The way this flex-handle bends back to clear obstacles makes this wrench the greatest spark plug tool I've ever seen!"

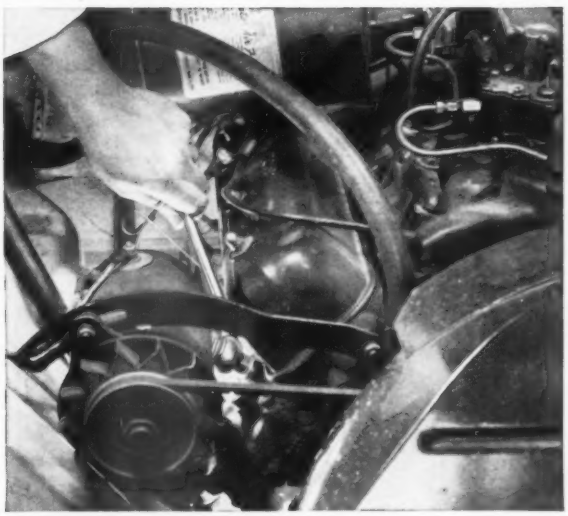
2. **"Look at those knuckles!** Not a new mark on 'em since I started working with my Plug-Master. Used to be always banging and burning them when I had to work down inside. But no more. The Plug-Master is a knuckle's best friend!"



3. **"With my Champion Plug-Master I** can work out in the open. See how this flex-handle bends back to clear the valve cover on this job so I can keep my hands up here without worrying about what happens when I free a stubborn plug. But that's not all."

World's favorite spark plug—engineered for every car built by Ford, General Motors, Chrysler, American Motors, Studebaker-Packard, and every major foreign maker.

Plug-Master wrench for 100 bucks"



4. **"You mean there's more?"** asked the salesman. "Sure. Like the time I save by not having to remove generators, filters and power equipment on most jobs. See how it gets at this plug buried behind the generator," explained the mechanic.

5. **"It's like a '2 for 1' deal.** I save so much time on some jobs that I can just about put in two Champion Spark Plugs in the time it used to take for one." "That's great for profits," said the salesman. "I'm going to sell *everyone* a Plug-Master assortment!"

6. **"Start by selling the boss two more.** Bill and Joe want their own Plug-Masters – and we can sure use more Champions. Do *all* your customers a favor," the mechanic suggested, "and sell them Plug-Master assortments – because Champion has the right tool and right plug for every car."

● The "Plug-Master" ratchet wrench is available from your wholesaler in any one of four assortments of 50 fast-moving Champion plug types. (One for the over-all car market, others specifically selected for Ford Motor Company, General Motors, or Chrysler Corporation cars.) Packaging in these assortments enables you to obtain this new wrench at the low price of $4.25.*

The "Plug-Master" has a hinge joint that permits 30° handle travel forward or backward. Full 12-tooth ratchet engagement. Only 6° handle travel required for next bite. Popular ⅜" square drive fits most spark plug sockets and extensions. Ratchet shift reverses easily – has positive-locking action.

**Suggested dealer price for wrench only. Assortment of 50 Champion plugs at regular dealer price. (Minimum dealer price established by Fair Trade Agreements in Fair Trade States.)*

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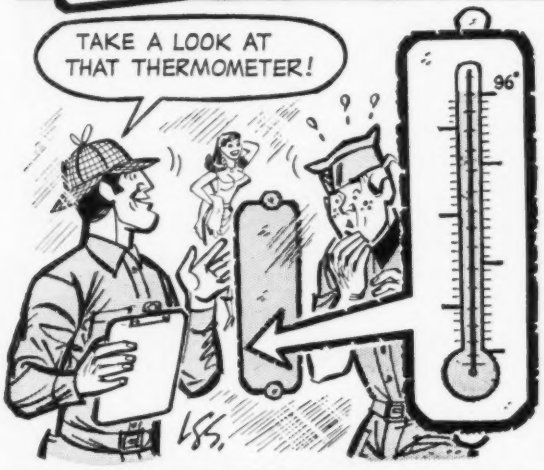
SHERLOCK, MISS GLAMARR'S REGULATOR KEEPS DELIVERING A HIGH CHARGE! THE BATTERY IS BRAND NEW AND THE REGULATOR TEST SHOWS THAT THAT IT IS SET AT A NORMAL 7.3 VOLTS.
ELEMENTARY, MIKE, MY BOY...



SHERLOCK, IT'S BLISTERING TODAY! BUT WHAT'S THAT GOT TO DO WITH ...
SIMPLE, MIKE — A HOT BATTERY OFTEN CAUSES SERIOUS OVERCHARGING EVEN AT THE NORMAL 7.3 VOLT REGULATOR SETTING. THIS IS A PERFECT EXAMPLE!

GOLLY, SHERLOCK— WHAT DO I DO?
ELEMENTARY, MIKE. SET BACK HER VOLTAGE REGULATOR TO ABOUT 7 VOLTS, BUT MAKE SURE TO RESET IT WHEN THE WEATHER COOLS OFF.
MIKE'S garage
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VOLUME XXXXVI
No. 558

Digest

July 1958

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Dunwoody Institute student getting an explanation from his instructor as to how the all-important distributor works . . . as well as how to service it properly.

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"TECH KNOW-HOW"
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For August

● Precision balancing of fast rotating and reciprocating parts has been associated with engine service work for many years. Now, however, considerably more emphasis is being directed to balancing such parts, brought into sharper focus because of the higher speeds obtainable from modern engines.

● For next month's issue we're going to conduct our readers on a tour through the realms of precise engine parts balancing, pointing out the basic principles involved, the equipment used and how the work is done quickly and with utmost accuracy.

● Much of the so-called rough engine operation—even though the customary service work of installing parts has been well done—lies in one or more moving parts being out of balance. We're sure readers will add to their mechanical "know-how" from the article.

● But, the balancing article is only one of several articles that will sparkle the August issue. . . . Additional articles on merchandising service, mechanic training, along with another in the series of servicing air conditioners, will highlight the issue.

Automotive clinic

Stuck on some problem? Need help on a job? Write us about your problem on your shop letterhead and the information you are looking for will be promptly sent you.

Address your letter to Automotive Clinic c/o AUTOMOTIVE SERVICE DIGEST, 900 S. Wabash Ave., Chicago 5, Ill.

Ben Ikert, Editor

Lighting System Trouble

We have a problem on our hands which is a new one to us. A 1958 Ford V-8 was brought in with trouble with the lights. After running 5 or 6 miles, the lights cut in and out, which is very annoying to the owner. We checked the ampere draw which was the normal 15 amps on the high beam and 11 amps on the low beam. After the engine got hot, the lights cut out altogether. As long as there was normal current draw in the light circuit we are wondering what could cause this condition. Just to be sure about the trouble we called the local Ford service department and told them about it. The man we talked to said they had had the same trouble several times and that all they did to fix it was to put on a new voltage regulator.

To see if this would make any difference, we disconnected the regulator altogether, which did not affect the condition at all. I forgot to mention that the voltage when the engine was running was 14.4, which is certainly normal.

As long as disconnecting the regulator didn't make any difference we would say that a new regulator wouldn't help because with the regulator out of the circuit the lights still cut out. Do you think we are right on this?

Any suggestions or information you can give us will be much appreciated. —*B.J., Chicago, Ill.*

Answer: Yes, we think you were correct in figuring that the regulator has nothing to do with lights cutting out. Cutting it out of the circuit by disconnecting it would certainly indicate this. About the only thing we can suggest is that the circuit breaker in the light circuit is either defective or too sensitive and this makes the lights cut out. Changing the circuit breaker should remedy the difficulty.

Engine "Lugging"

When you say an engine is "lugging," just what do you mean? I know it means making an engine pull a load, or overloading it . . . but what I would really like to know is just how are high pressures formed in the cylinders by lugging to cause damage to main bearings and blow head gaskets?

I've been asked the question several times by customers, and I could never really give them a clear explanation of it.—*J.P.R., Hollis, L.I., N.Y.*

Answer: "Lugging" is the term applied to the action of an engine running at a fairly low speed with the throttle opened wider than it should be for that speed. This increases the cylinder compression pressure and firing pressure, putting excessive stress and strain on all engine parts. Actually, it is over-loading the engine at low speed.

An engine generates its power in proportion to speed, as speed is one of the factors in figuring horsepower. At low speed the engine cannot deliver as much power as it can at higher speeds. With manual transmissions, lugging is caused when the engine is working in a higher transmission speed than it should for the load conditions.

Olds Engine in a Chevy?

What we would like to know is: can a '50 Oldsmobile engine be put in a '49 Chevrolet? How would the work be done and what would have to be done to the Chevrolet?—*E.R.S., Wallingford, Conn.*

Answer: You have given us so little information, it is hard to do more than give a few general instructions.

The '49 Chevrolet was a 6-cylinder, with standard manual transmission. The Olds had two engines in 1950—a Six and a V-8. You do not say which one you want to use, or whether the engine has a manual or Hydra-Matic transmission.

To put in a different engine, you will have to get an adapter ring to make the connection between the engine and transmission, unless you are going to change transmissions. The length will probably be about the same, but the engine mounts will no doubt be differently located, which will require different mounting brackets or adapters in order to mount the engine. Also, if you change transmissions you will have to adapt the transmission controls and control linkage.

Chevrolet had a torque tube while Olds had a Hotchkiss drive, so if you try to change transmissions there will be a problem in adapting the Olds engine to the torque tube drive. If you can get an adapter ring to connect the Olds engine to the Chevrolet transmission, you can probably make the change without too much trouble.

Hot Engine Won't Start

I have read all the Clinic Letters with a lot of interest and have gotten a good many pointers that have helped me in my work. Now I have a tough one that maybe you can help me with.

We got a call from a customer that his 1953, 6-cylinder Plymouth engine would not start when it was hot and was stopped for a little while. It would start all right when it was cold, but nothing the owner could do would get it started again when it was hot.

He was told to let it get cold, then start it and bring it to the shop. The next day he drove into the shop, shut the engine off and then we tried to get it started but couldn't. We checked the battery and checked the circuits with the voltmeter for voltage drops; checked the timing and dwell, and checked the fuel pump. Everything checked out OK. We let it set until it cooled off and then it started up all right. We checked again but couldn't find anything wrong. What have we overlooked and what can you tell us that might help?—*R.W., Elgin, Ill.*

Answer: We have had cases like this come up before where the trouble was cured by changing spark plugs. If you can make an oscilloscope test you will probably find that the required voltage is much too high. One job that we were called on to help was tested with an oscilloscope and it

(Continued on page 60)

TO SERVE YOU AS YOUR

RIGHT HAND MAN

For more than a quarter century, the SUN Representative has been a Right Hand Man to the Automotive Service Industry—providing specialized technical knowledge and training in the use of scientific automotive testing equipment. Today—the "Man From Sun" is known for his integrity—his complete understanding of any problem concerning automotive testing.

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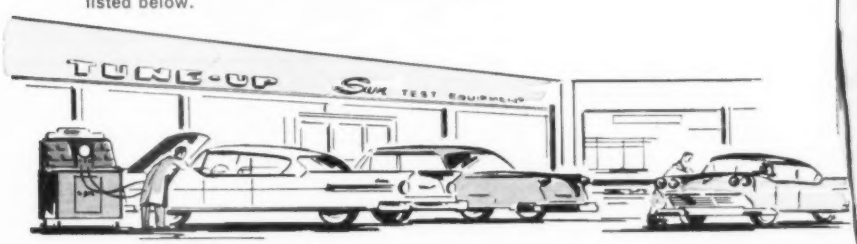

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Conducted by The Instrument Man in the interests of simpler, faster, more satisfactory—and more profitable—service operations.

High Resistance Causes Kick-Back on Tune-Up Job

• HERB WAS ONE of those fussy guys who keeps a record of everything pertaining to his 1956 Plymouth. The car seemed to be running okeh, and he was getting 15.1 miles per gallon; but he decided that the car should have a tune-up. He wasn't too sure just what he would receive in the way of a "tune-up" — but that is what he ordered.

A week after the tune-up was performed he was horrified to find that his gas mileage had dropped from 15.1 down to 11.1 m.p.g., and he rushed back to the shop that did the job and told them about the drop in gas mileage.

Being anxious to please their customers and treat them fairly, the boys in the shop went over the engine carefully—checking back on all their work; but nothing showed up that would account for the less efficient operation. A road test did show a high speed miss, but further checking back, including secondary efficiency, did not reveal the reason for the miss.

The customer was told to leave the car and pick it up the next day, after which a call was put in for the Instrument Man. When he arrived at the shop, the boys told him everything they had done, and about rechecking their work. After pondering the question a minute, he said, "You know that oscilloscope I was telling you about? Well, it so happens that I have one in my car, and this will be a good time to demonstrate its trouble-shooting capabilities to you." So he brought in the 'scope, hooked it up to the car in question and started the engine.

The instrument was adjusted to show all eight cylinder traces, and what do you know! As plain as the nose on your face, two of the cylinders showed that something was wrong. "Look, boys," he said, "even without knowing just what the trace or picture on the 'scope screen means, you can plainly see that there is a difference in two of the cylinders. The cylinders are shown in the same order as the engine firing order (1-8-4-3-6-5-7-2), so seeing that the third and sixth cylinders on the trace show trouble, that would be cylinders numbers four and five.

"When you get to know how to read the 'scope indications, you will know that the trouble you see here is caused by high resistance. Let's short out those two plugs, one at a time. If the trace then indicates a shorted plug at each point, it will prove the trouble is the plugs." So he shorted each questionable plug, and sure enough, the trace lengthened out and its amplitude became much less than the traces of the other cylinders.

WHY INSTRUMENT CORNER?

Because we know the help he's given so many shops first-hand is just as valuable in the re-telling as it was in the happening, we've asked The Instrument Man to pass along some of his more interesting experiences. As an old-timer in automotive servicing who is distinguished by the fact that he's kept up-to-the-minute on developments in his field, The Instrument Man gets many calls for help from friends, acquaintances and even strangers, in shops large and small. He generally solves the cases, because of his understanding and appreciation of trouble-shooting instruments.

The questionable plugs were removed, and examination showed that the resistors in these plugs had actually disintegrated into dust. This permitted a spark to jump at idle and low speeds, giving ignition that would explode the fuel-air mixture, even though inefficiently. At higher speeds, however, the spark would not jump, due to the higher required voltage, and as a result the engine missed at high speed.

The required voltage on the bad plugs was 10,000 to 15,000 volts, whereas it normally should be about 3,000-5,000. The oscilloscope will show up this condition very readily, and it is about the only quick way to catch it.

An ohmmeter can be used, connected across the plug from the end of the center electrode to the top contact. If the resistance of the resistor is over 15,000 ohms, you can rest assured that the plug is on its way to failure. Open resistors, such as appeared on the two plugs on this job, will show infinite resistance.

The use of the ohmmeter will pick out bad resistor-type plugs, so in the absence of an oscilloscope, remember to check resistor plugs with the meter. If you don't have either an ohmmeter or an oscilloscope, you are out of luck in finding trouble such as this.

P.S. The boys in this shop placed an order for an oscilloscope.

Poor Regulator Ground Impedes Current Flow

• THE INSTRUMENT MAN casually stopped by the shop of one of his customers, with no special object in mind except to see how the boys were getting along and to tell them of a new Tune-Up class that was going to start in a couple of weeks.

He was almost startled when one of the men came up to him and said, "Boy, am I glad to see you—I've got *me* a problem!" . . . and he went on to tell his troubles.

It seems that a 1955 Dodge was brought into the shop for a tune-up because it was running poorly. All the operations involved in the shop's tune-up procedure were performed, and in the process, it was found that the secondary polarity, which should be negative, was actually positive, so the coil terminals were reversed.

The car owner also complained that the battery had to be recharged frequently, so the regulator voltage was stepped up a little. In a week, however, the car owner was back with the complaint that the car still did not run right. A few tests were made,

(Continued on page 61)

These... ...Snap-on® Tools Put Armature Reconditioning Profits in your own Pocket

Why send armature business — and profits — down the street when you can keep them "at home" with these low-cost *Snap-on* armature tools?

No strain on the budget either. You can pay out of profits with *Snap-on's* popular easy payment plan.

There's big volume, too. Armatures must be kept in top shape to match the heavy electrical loads put on today's batteries. It will pay you to talk armature with your *Snap-on* man the next time he calls.

AT-2X ARMATURE RECONDITIONING TOOL SET

This inexpensive tool turns down armatures with same precision as expensive lathes and does the job faster — without removing back plate. Requires no motor, no special centerless chuck.

Armature lowers automatically as cut is made. Cutting depth controlled to finest shaving. Interchangeable collets adapt tool to various size armature shafts. Tool locks in vise or fastens on special metal holder (see photo).

MT-325 ARMATURE GROWLER

A "must" for reconditioning generators, starting motors. This new heavy-duty growler uncovers type of defect, pinpoints its location — spots defective wiring, poor connections, severed coils, transposed leads, grounds, open circuits. Two heavy-duty, 2-way switches, one for on-off, the other for high-low resistance. Special isolation coil winding eliminates shock hazard. Unit complete with 0-30 ampere meter, extra-heavy power cord, two safety-tip insulated probes, adjustable bar-to-bar probe, test light.

UC-6 MICA UNDERCUTTER

Precision-built to do a superior undercutting job, the UC-6 handles wide range of commutator sizes without frequent adjustment. Self-cleaning blade eliminates chip packing. Three blade widths, .015", .020", .025".

AT-2X Reconditioner, AT-3-1 Stand, AT-3-2 Baseboard, UC-6 Undercutter, and MT-325 Growler.

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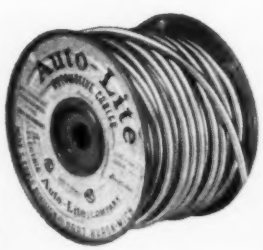

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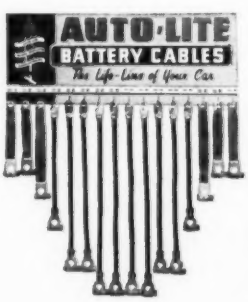

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Editor's page

Unit location standardization

● A FEW YEARS AFTER the founding of the Society of Automotive Engineers in 1905, attention was directed towards establishment of design and structural standards.

It soon became quite obvious that, along with production cost-cutting, time would be saved in replacement of repair parts of the various makes of motor vehicles by standardizing the main dimensions and supporting points of such parts. Over the ensuing years this standardization has gone constantly forward and its value to the maintenance, service and repair segment of the industry has been great.

Consider, for example, items like screw threads, carburetor and manifold flanges, axle shaft taper, splines, generator, starter and magneto mountings, flywheel bell housings—to name a few. Imagine the resulting chaos in service work if such standardization were non-existent, let alone the building of motor vehicles which entails the buying of units from many different suppliers.

SAE standards are a blessing in other ways. Think how they cut down, for instance, the number of different gaskets that would be needed . . . how much "cobbling" a service mechanic would have to do if a customer demanded installation of some other make of carburetor, the base of which didn't jibe with the original part. A little reflection along these lines brings the true value of standardization into proper perspective.

When browsing amongst automotive servicemen and talking standardization, another type of standardization is frequently brought up for discussion. It has to do mainly with standard location of units or controls most frequently worked on. For example, many feel that insofar as it's possible to do so, the location of units like the master brake cylinder, generator regulator, oil filter, hand brake controls, fuel pump, transmission push buttons and similar elements in substantially the same relative position on all cars, would be an advantage service-wise.

Unit location standards might be something to think about. The ultimate realization would help in speeding service; would aid in mechanic training programs, and probably cut down the trend toward special tools and "gimmicks" now often necessary to cope with well-hidden accessories.

Perhaps the designs for tomorrow's cars are 'way ahead of us on this. Let's hope so.

Ben Ikert
EDITOR

Trade training for "those fitted"

Modern dealer and independent service shops badly need men with the "tech know-how" to use precise, versatile equipment and instruments on today's complex cars. Where will those with a natural "knack" get the broad, intensive training to translate aptitude into valuable, specialized industrial skill?

● "TOO MANY young men think they should earn a living without getting their hands soiled. I want to encourage them to learn a trade, provided that is what they are fitted for."

With those words, which are as timely today as when he spoke them prior to World War I, William Hood Dunwoody forecast the outstanding school that bears his name. He was then in his seventies and in failing health, even as he confided to a close associate his dream of establishing a trade or vocational school to provide instruction in the industrial and mechanical arts.

That dream became reality: the William Hood Dunwoody Industrial Institute, Minneapolis, Minn., which supplies the automotive service industry with the highly-trained graduates of one of its largest divisions—the Automobile Department. Made possible by a bequest of more than $3,000,000 from Dunwoody, who died in early 1914, the school was officially dedicated in December of the same year. It opened its doors as an endowed, non-profit trade school . . . the first in the Northwest . . . with an enrollment of 80. By January, the student body had grown to 170; and in the years since, some 180,000 men of from 16 to 60 have received training in industrial, mechanical and technical fields in Dunwoody's Day School and Evening School extension course classes.

"Very few teachers *talk* their way into a job here," Day School Director John A. Butler remarks in describing the teacher hiring policy. His point—that the Institute draws its instructors primarily from industry—reflects the emphasis that is placed on meeting the Founder's ideal of providing trade training that gives the student practical, usable "know-how" for the job.

THE PRACTICAL COMES FIRST

From the beginning, in 1914, the Day School has offered full-time courses of the pre-apprentice, pre-employment type, preparing the student for immediate entrance into the trade of his choice. Instructors are usually experienced tradesmen who have first proved their ability on the job—as journeymen, foremen, etc. in the work they teach—then are converted by the school into teachers. For example, the Automobile Department instructors have successful background records as service specialists, service managers, foremen and shop supervisors.

Members of the Institute staff are active in the SAE, Midwest Fleet Safety Supervisors, Minneapolis Service Managers, Auto Electric Association, Automotive Service Technicians, Minnesota Safety Council, M.T.I.A. and

Well-equipped, spacious service department where students get adjustment and overhaul training on different makes of cars.

M.V.A. Dunwoody works closely with the University of Minnesota's Industrial Education Department, supplying the shop courses required by the students in Industrial Arts: and in turn, the Industrial Education Department of the University arranges for in-service teacher training for Dunwoody instructors.

During the past year, the Automobile Department had 10 instructors attending training courses, which ranged from one day to 100 hours in length.

NO AGE BARRIER

Equally practical on the student level, Dunwoody places no age barrier in the path of advancement. Men who have been many years out of school, but are still ambitious and willing to work for advancement, find their way into the Institute's student body. A special department helps them in brushing up on fundamentals.

To succeed at Dunwoody, a student need only be able to understand and apply the basic operations in arithmetic (and in certain courses, elementary algebra), and to read and comprehend the technical instruction sheets, manuals and textbooks. The requirement for admission is sufficient educational background to handle such material and progress satisfactorily in the school work. Where there is doubt, the applicant is interviewed before being admitted to the course.

Those who've had previous training—in other schools, company programs or the military—may be granted credits toward the Dunwoody course. In such cases, the amount of credit granted is determined by oral, written and performance examinations after enrollment.

DUNWOODY INDUSTRIAL INSTITUTE

WEEKLY SCHEDULE FOR FULL-TIME DAY SCHOOL

TRADE AND INDUSTRIAL TRAINING

(Illustrative—Varies by Training Period and Department)

	Monday	Tuesday	Wednesday	Thursday	Friday
8:15					
(1)					
9:00	**SHOPWORK—LABORATORY**				
(2)	**PRACTICAL—TECHNICAL**				
9:45	Selected Training Jobs				
(3)	Typical—Doing Experiences				
10:30	Individual—Realistic				
(4)	Experiments—Exercises				
11:15	Production Work				
(5)	**JOB KNOWLEDGE—SPECIFIC KNOW-HOW**				
	How—Why—Demonstrations—Hazards—Safety				
12:00	Questions—Applications—Implications—Regulations				
(6)	**LUNCH—RECREATION—RELAXATION**				
	Cafeteria—Gym—Clubrooms—Library				
12:45	Poolroom—Games—Movies—Publications				
(7)	**TRADE KNOWLEDGE—RELATED INFORMATION**				
	Materials—Tools—Machines—Processes—Kinds				
1:30	Types—Sizes—Availability—Costs—Trade Literature				
(8)	**APPLIED SUBJECTS—ASSOCIATED TECHNICAL**				
	Terms—Definitions—Blue Print Reading—Sketching				
2:15	Calculations—Formulas—Science—Specifications				
(9)	**GENERAL—COMMON—TOOL SUBJECTS**				
	Remedial—Arithmetic—Spelling—Speech—Library Assignments				
3:00	Letters—Slide Rule—Bookkeeping—Business Practices				
(10)	**GENERAL—PERSONAL—CITIZENSHIP**				
*3:45	Employer-Employee Relations—Health—Salesmanship				
	Insurance—Labor Laws—Social Security—Study Periods				

Form 275 1-58 5M

*During certain training periods some students may be scheduled 9:45 to 5:15

6¾ Hours Per Day (Nine 45-Minute Periods of Instruction)

33¾ Hours Per Week

One 15-Minute Daily Mid-Shop Recess

Dunwoody student checking run-out in wheel alignment class.

A DREAM WORKING

Over its 44 years of expanding service to industries, the Institute has reached the point where it draws students from nearly every State in the Union, from Canada and from some countries abroad (students, instructors and school administrators have come from 20 different countries). Its student body today numbers approximately 1,000 in the full-time Day School; with another 2,500 taking part in the extension training courses of the Evening School.

First informally, then through the Alumni Fund organized in 1940, the graduates of the school have helped its growth by building the endowment and other activities. Generally speaking, the Alumni Association has brought the school into close and continuous contact with industry, labor and other interested organizational "friends" whose cooperation helps forward the training of skilled technicians. The Institute, of course, maintains the closest relations with the fields in which it offers instructions in more direct day-to-day work, as well.

All this background and widespread interest and support is "wrapped up" for the student in the Certificate and Graduation Pin he wins on completion of his course. The Pin, incidentally, was designed by the students themselves, and is presented at the graduation ceremonies.

THE TRAINING "TICKET"

Those who choose the Dunwoody route into the automotive service field—or into a better niche in that field, if they have already entered the work—usually must plan to spend a year and a half at the task of becoming skilled tradesmen. Men "starting from scratch," without previous experience, usually enroll for the full course. Individuals who obtain credits for previous experience or training, can adjust their schedule as they go; and often arrange for special courses, on this basis, when enrolling. The faculty offers a wide selection of courses, to permit students with previous experience to "tailor" their school work toward specific objectives within their trade.

(Continued on following page)

Students who cannot complete the full course, may withdraw at any time.

Dunwoody's school year consists of 10, 4-week periods, extending from the beginning of September through the middle of June. The school day (as shown in an accompanying illustration) provides for 6¾ hours of instruction, five days a week.

All three of the courses offered by the Automobile Department of the Institute—General Mechanical, Auto-Electrical, Body and Fender Repair and Refinishing—are 18, 4-week periods in length.

tending under Public Law 550 (U. S. Government assistance in the form of an Education and Training allowance), the fee is $48 per period. In all cases, there is a registration fee of $20, payable at entrance; and the fee for each period is paid in advance.

These rates apply to the current year, 1958-59, and, of course, may be revised for future terms. They cover all necessary books and supplies. The school applies no special fees whatsoever; however students are expected to provide their own shop clothes. Students who withdraw, and thus interrupt their continuous enrollment, are

Students in the electrical shop, using factory manuals, get into the innards of units on tests and repairs.

According to the school, the system based on 4-week periods . . . 20 school days in each such "unit". . . offers a number of advantages to the student. They may enter or withdraw at convenient intervals; and will have completed a clearly defined portion of the course for each period. Thus, when a student who had previously dropped out, returns to resume his studies, he need not repeat large blocks of work. Another argument advanced for the system is that it permits the institution to graduate students continually throughout the year . . . so that they can be more readily absorbed by industry than two or three large classes.

Students are enrolled periodically, as full classes start, and are advised of the probable date at the time they register and are accepted. During the first few months in school, the progress of each student is checked closely, to determine which members of the class may need special help or counsel. Anyone who finds his subjects particularly hard is interviewed by both the department head and a counselor, to determine and eliminate the trouble. Beginning with the current school year, each Dunwoody student is assigned an instructor-advisor to assist and counsel him throughout his course . . . in addition to the long-established faculty counseling service available to all students.

As another practical help to the students in getting the most mileage out of their own abilities, the school can arrange "tryout periods" for those who are undecided on just where they'd fit best. They can start out on the subjects that are "first choice," then switch to a different course or department after a month or two of experience . . . which may result in a change of heart, or show up a lack of the particular talents for the first specialty.

FEES AND LIVING COSTS

Day School fees for residents of Minnesota are $25 per 4-week period. For non-residents and for veterans at-

charged a re-entry registration fee of $20 . . .in each case.

Sleeping rooms are generally available, some within walking distance of the school, and range in cost from $6.00 to $8.00 a week depending on size, location and individual requirements. The School cafeteria serves meals at slightly above actual cost . . . so that a student can budget out three meals a day at approximately $9.00 a week.

Projecting these figures over the 18-period automotive courses, the prospective Dunwoody enrollee finds: for a non-resident or veteran, the total of school fees would be $884 for continuous attendance. Food he can expect to manage on $648, exclusive of week end meals, through the entire course; and lodging would amount to $432-$576, depending on his selection. Budgeted out, these amount to $1,964 for 72 weeks of instruction to the non-resident or GI student. Residents, because of the difference in fees, would come out for $1,555 . . . unless living at home in the Twin Cities, in which case they could be "home free" for in the neighborhood of $1,123.

STUDENT AID

Students who find it necessary to work part-time to defray some of the expenses of their technical education, are helped to locate suitable employment by an Institute department. Of course, Dunwoody is unable to guarantee such work . . . but it has assisted many of the enrollees in meeting their financial problems and thus obtaining the type of training the school was founded to provide.

In addition, one of the prime activities of the Dunwoody Alumni Association has been to make it possible for deserving young men to overcome lack of finances. As a result, it has established a number of scholarships through contributions from the alumni, business and industrial concerns and labor organizations. These scholarships cover as much as 75 per cent of the fees for nine months of attendance. They are granted on the basis of need, primarily.

All applications for scholarships are screened carefully by the Institute's Scholarship Committee, which of course gives first consideration to those whose need is greatest and who have good school records. The group is also interested in the applicant's personal qualifications and accomplishments. A special bulletin describing the Dunwoody Scholarship plan is available from the school (Admission Office, 818 Wayzata Blvd., Minneapolis 3, Minn.).

AUTOMOBILE DEPARTMENT COURSES

Generally speaking, the Dunwoody philosophy of technical training is based on learning by doing. Trainees work on typical trade jobs, and with current shop tools and equipment. Instructors teach the practices and standards they've personally learned in the field itself. However, while a large part of each day is spent in shopwork, the courses are rounded out by classwork, which the instructors time to the phase of service practice being covered in the shop, and "tie-in" with demonstrations and discussions of special trade tricks and mechanical "short cuts," etc. In the same sessions, the students are urged to raise and clear-up specific questions.

Each of the three Automobile Department courses has its own specific "Employment Objective," although as might be expected, General Mechanical and Auto-Electrical do overlap considerably . . . as will be evident from analysis of the respective periods. All three, however, put the student through 360 days of instruction—a total of 2,430 hours of training in shop and classroom combined. In the General Mechanical schedule, the trainee works on school equipment for 10½ of the 18 training periods, and on the cars of fellow students and employees of the Institute during the remaining 7½ periods . . . all of this in the atmosphere of a well-run service shop.

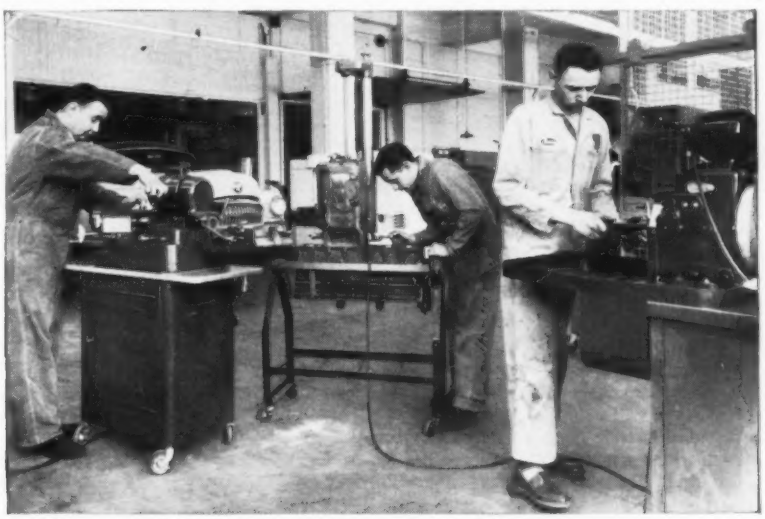
Moving into Auto Electricity, he is given experimental jobs involving series and parallel circuits, magnetism, soldering, splicing and use of meters; and is familiarized in this manner, with the principles of electricity and magnetism, and the inter-relationships of volts, amperes and resistance as they apply to automobile installations.

His third basic, Auto Mechanical and Electrical Applications, puts the information and skills he's picked-up in the first two units of the course, right to work on such familiar service tasks as miking pistons and cylinders, fitting piston pins and rings, fitting spindle bushings; wiring ignition and lighting systems; taking apart and putting back together, carburetors, distributors, generators, starters . . . even horns, and tuning-up and operating four-, six- and eight-cylinder engines.

Starting this year, the trainee moves from this point on to Automatic Transmissions, a new unit of study that reflects an advance within the industry itself. This period replaces Machine Shop—the important elements of which have now been incorporated in other study units.

After the sixteen weeks just described, students are considered ready for Engines. Here they completely tear down live engines . . . including electrical units, carburetor and fuel delivery system. Bearings are checked for clearance; camshaft and crankshaft, timed; piston rings removed and replaced; pistons and rods are aligned. Finally, the engine is completely re-assembled, operated, and given a tune-up with shop equipment.

Chassis, is the following study unit . . . providing an intensive grounding on popular makes. Jobs the student handles include transmission, clutch and rear axle disassembly; differential ring-gear and pinion adjustment; bleeding brake lines and adjusting brakes; the disassembly and re-assembly of wheel suspension units, and



Practical training jobs on various types of engines teach fundamentals of construction and repairs.

Let's see what the Dunwoody student packs into his mental "tool box" in each course:

General Mechanical—Leading off into the basics of his future specialty, the student gets 20 study days each of Auto Mechanics, Auto Electrical, and Auto Mechanical and Electrical Application. The first takes him through shop jobs on front and rear axles, clutches, transmissions, steering gears, brake systems, engines; acquaints him, by the actual acts of disassembling and reassembling the units, with the names, construction and functions of parts, and with the necessary tools and their uses.

setting camber, caster and toe-in.

With 24 weeks behind him, the trainee next takes six units of Garage in succession, working on customer cars. These take him through diagnosis of trouble and performance of the needed work, for a starter, in Garage I, which utilizes the skills and "know-how" he picked up to date. Next, he gets thoroughly into front end and steering gear, in Garage II; brakes, in Garage III . . . covering the "waterfront" of service shop situations; transmission and clutches in IV; differentials and universals in V, and finally, an exhaustive "going over" in tune-up analysis

(Continued on following page)

and service—from the wheezing "push-in" to the successful road test, in Garage VI.

Now two-thirds along in his service education, the trainee takes up Carburetion and Fuel System—plunging far deeper into this subject than in the earlier periods. For 20 school days he delves into the principles and the repair and test procedures on popular makes of carburetors . . . practices the use of analyzing instrumentation . . . learns where and what to check according to the customer's complaint. Poor mileage, lack of power, hard starting, flooding, irregular idle and stalling—all receive their due in this period. To them are added thorough instruction in the operating principles, test and repair procedures for fuel pumps, automatic choke controls and gauges; and in utilizing service manuals advantageously.

Moving along to Trouble Shooting, the student "bugs" the car with selected troubles . . . studies the effect on lock, flat spot in acceleration, engine noise or miss.

When he has successfully run this gamut of problems, and mastered the "know-what" and "know-how" required to meet and master them . . . the General Mechanic student has nothing more ahead of him except his graduation ceremonies and the prospect of employment in a good service shop. He knows, but does not fear, that the day-to-day flow of work, will add still more to his skill and satisfaction in the trade he's chosen.

Auto Electrical—Necessarily, this course overlaps the General Mechanical subject matter a good deal. Eleven of the 18 study units, in fact, are common to both schedules: the three basics, Auto Mechanics, Auto Electricity, Auto Mechanical and Electrical Applications; Engines; Auto Electricity I, II, IV and X; Trouble Shooting; Garage VI, Tune-Up Analysis and Service; and

Most students of body repair and refinishing enroll for the full course, reaching a higher employment level.

performance and on test instrument readings; for example, those obtained with vacuum and compression gauges, engine and combustion analyzers. In turn, he faces job assignments in which the engine is endowed with trouble for him . . . and he tests his skill in analysis.

For the four final 4-week periods of this course, the Dunwoody trainee works on Auto Electricity: units, such as distributors, cranking motors, generators, storage batteries, coils and condensers; operation of units, which covers the basic principles and functions, gives detailed instruction and practice in the use of shop test instruments; wiring systems, offering practical experience in tracing circuitry, wiring automobile electrical units, locating troubles on cars brought in for service.

"KNOW-HOW" PUT TO PRACTICE

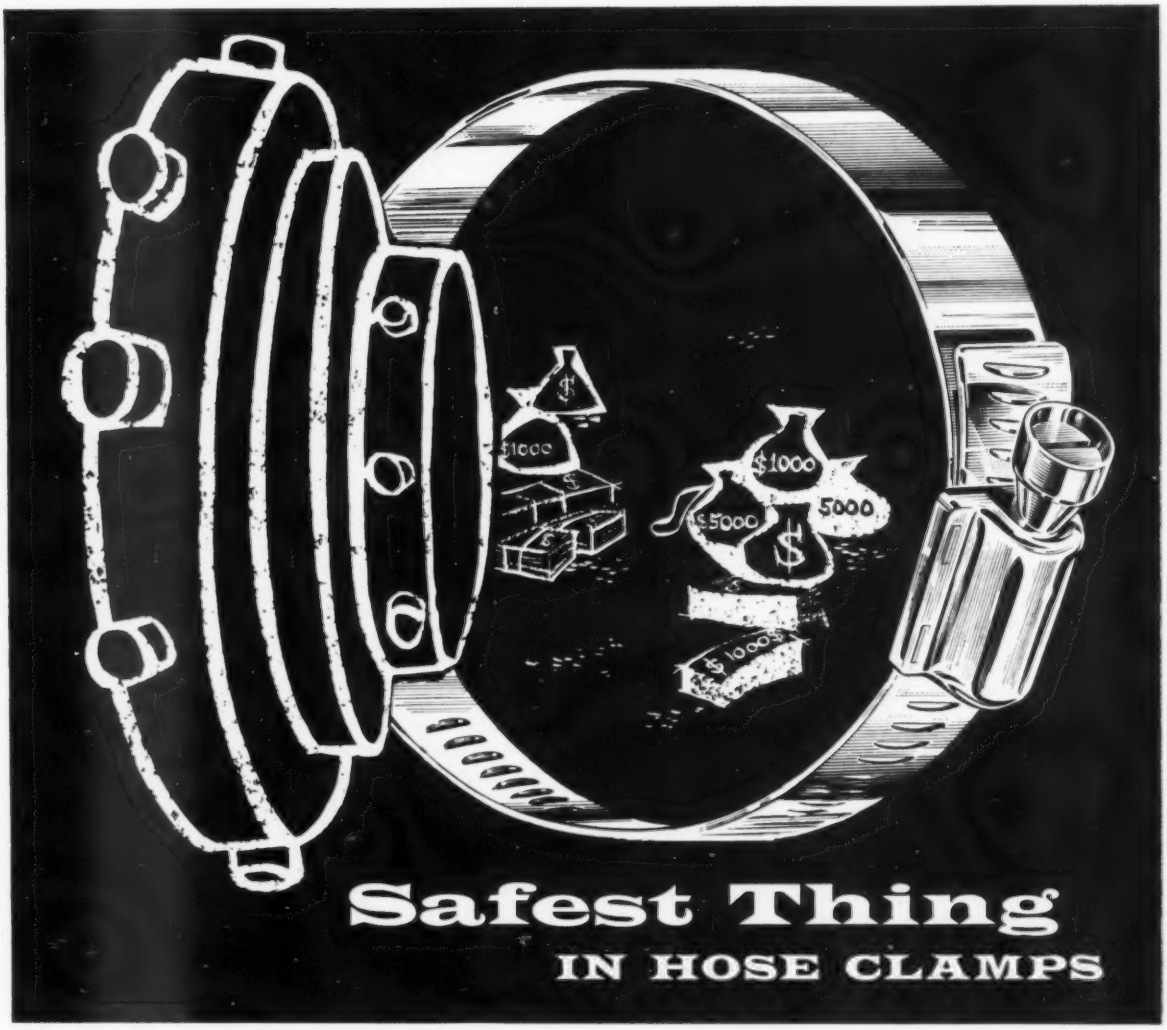
Following these three units . . . Auto Electricity I, II and III . . . comes the finale, represented in Auto Electricity IV, Tune-up Service. Now, in his last study hours, the enrollee in General Mechanical uses various makes of test equipment on a range of cars brought in for servicing. His assignments require that the trouble be located, the car restored to smooth and effective operation . . . all units that were malfunctioning put back properly to manufacturer's specifications. Typical tasks that must be handled under the demanding eyes of the instructor include low mileage, hard or sluggish starting, vapor Carburetion and Fuel Systems.

In mastering the electrical phase of automotive service as his chosen specialty, the Auto Electrical student takes six additional 4-week study units in that subject. These are Auto Electricity III, which goes more exhaustively than does II into the operation and testing of units; covering additional makes and models and providing advanced instruction in testing and adjustment . . . Auto Electricity V through IX. The latter five periods are devoted to Magnetos, Accessories, Small Engines and Bench Service, Wiring and Heavy-Duty Units, and Bench Service. When he has reached IX, the student is estimating jobs and ordering parts, as well as doing the type of service characteristically handled by the auto electric shop. He has also long-since completed the Machine Shop study unit, in which he develops the required skills in drill press and lathe operation; learns to lay out work, sharpen drills and grind tool bits; drill, tap, file and turn metals.

For him, the Tune-Up Analysis and Service, Garage VI, is the end of the study road. He wins his Certificate and Award Pin, and is ready for the bigger, more stimulating challenges of industrial employment.

Body and Fender Repair and Refinishing—as should be expected, the course in this specialty is similar to the other two offered by the Automobile Department of Dunwoody mainly in the manner the subjects are presented,

(Continued on page 18)



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and in the "tailoring" of the material and teaching toward a specific objective. The employment objective is "all-around training" in the repair, painting and refinishing of automobile bodies and fenders; frame and body alignment; installation of upholstery, body trim, hardware, door locks and remote controls, glass and window regulators.

TUNED UP-TO-DATE

Trainees run through their four-weeks of Auto Electricity IV, Wiring Systems—which is included in both the other courses—as the first order of business. Next come, in order, Garage II, Front End and Steering Gear, and Garage III, Brakes—both also "built-into" the General Mechanical schedule. After these 12 weeks, Body-Fender specialist trainees veer off onto their own course.

Gas Welding, gives them practice in the fundamentals of using the torch, drills them on safety practices and proper handling of body shop equipment . . . even offers some practice in welding light metal. Arc Welding provides the necessary instruction and practice in the fundamentals, and considerable work in welding body and fender type material. Continuing, the Body-Fender students takes three periods—12 successive weeks of Metal Work: I and II are on chassis, moving from the instruction in basic tools and nomenclature, with practice in bumping out, aligning, welding and metal finishing on mock-ups, into actual work on fenders of various makes; while in III, Body, the trainee advances to live jobs . . . learns to straighten and align doors, trunk lids, radiator shells and grilles on bodies that are damaged without frame misalignment.

Frame Alignment is sandwiched into the schedule next for its four-week due; and takes the student through to the handling of heavy damage. Four more periods, a total of 16 additional weeks, are devoted to Body Work IV-VII, and are followed by the same length of time on Painting and Refinishing, I-IV. By the time he has progressed to this point, the Dunwoody student is expected to be thoroughly versed in live work ranging from the simplest uses of the spray gun to delicate color matching and spot repairing.

His final four weeks are spent on Estimating. In this, he is required to act as a shop foreman, write the repair orders, correctly estimate the cost of materials and labor on every job that comes into the shop. He is then graduated, ready to make his own future in his field.

In the close contact that Dunwoody maintains with industry, the Automobile Department makes every effort to "stay on top" of new developments in its field. For example, it assists in setting-up factory schools, supplying space or both classroom and shop space and the instructors as well . . . has for years trained all the Highway Patrol's lamp and brake adjusters . . . often helps auto dealers, who bring in cars with special service problems for the staff and students to solve. Often the dealer's Service Department personnel work with the Dunwoody people on such jobs.

School facilities (some of them shown in the cuts on these pages) are patterned after typical service shops . . . and are constantly modernized and expanded in keeping with the trends of the industry. Frequent surveys and consultations with industry groups are employed by the school to keep its instructional material and equipment abreast of practices in the trades. Tools, machines and instruments are discarded when they've become outdated in the service field itself; and replaced with the latest types. There is particular emphasis on the part of the Institute staff, in making the student's school "atmosphere" . . . as he learns . . . truly typical of the conditions under which he will work. The Garage is run, in all respects, like the best dealer service department or independent service shop.

The teaching load—always a key to effective instruction—is also held to the best recognized standards. In the Automobile Department, which with some 200 students is one of Dunwoody's largest, the number of students per instructor is held to about 18. Each instructor has his class for a three-hour shop period and three related technical information class periods, daily. When the course reaches the point of the Garage, the trainee's shop time is increased to four and a quarter hours, and his related classroom work cut to one hour daily. In the six Garage periods, the instructor concentrates on raising the student's speed, as well as his competence, to acceptable trade standard.

One of the methods the Institute uses to keep its teaching staff up-to-date on those standards, is the three-year rotating plan that all instructors follow. One summer is spent at Dunwoody, working over lesson material and equipment (courses in all Departments are continually revised and up-dated). The second summer, the instructor is placed in an industrial job, where he handles the current service problems of the field he teaches; and the third, he attends professional classes at the University of Minnesota or some other ranking educational center. Often too, the instructors attend factory schools.

On the student's part, there is also opportunity to play a role in the "big picture" of the school . . . the Student Advisory Forum. All Departments elect student representatives to this group, which meets twice monthly to air questions and problems—which flow freely—and to promote broader understanding of all matters of common interest between the staff and the trainees.

Nor is there much possibility of the student's being restricted in his search for knowledge, nor mentally dulled by a diet of study alone. On the one hand, the Evening School . . . which the Day students may attend if they wish . . . offers a wide spread of short courses. These run, generally, one night a week, four hours per evening during the Evening School year of October-April; and permit those interested to "load up" on specialized instruction related to the Course they are taking in the Day School. On the other hand, there are a number of student clubs in which the members enjoy themselves socially while following hobbies.

THE FUTURE FOR "THOSE FITTED"

In common with the graduates of other good trade training centers, those of Dunwoody seem to find little difficulty in landing a job . . . with good prospects for advancement . . . in industry. The school's Placement Department works with employers and with State, Federal and private employment agencies to find suitable employment for all students—whether graduates or not. It is considered a cooperative plan working, at no charge to the job applicant, in behalf of both the trainees and the automotive industry.

Dunwoody Alumni have "fed back" to the Institute, such benefits as a growing Alumni Fund, and specific contributions including: movie and slide projectors, clock and bell system, visual aids and vocational counselling, a library and projection room, 25-year service records and Trustee plaques, and a sound-color movie, "How Dunwoody Serves," about the institution itself. This loyalty and its steadily growing impact on strengthening and extending educational activities is one of the most dramatic testimonials to the foresight and wisdom of William Hood Dunwoody in founding what the *Minneapolis Journal* of his day described as:

"A great industrial school . . . where youth may be better fitted for the performance of life's duties."

Looking like so many Jonahs in the whale's mouth, contestants work feverishly to correct 14 pre-arranged maladjustments in cars. Each two-man team is closely watched by a team judge to make sure only safe work practices are used and to supply needed replacement parts.

Detroit automotive vocational students receive recognition of their tech know-how prowess in . . .

Plymouth's trouble-shooting-contest

● TEAMS FROM Washington Trade School and Wilbur Wright school tied recently as the champion automobile trouble shooters of the Detroit school-boy set in a contest sponsored by the Greater Detroit Plymouth Dealers Ass'n. and Plymouth Division of Chrysler Corp. The winners defeated 18 other teams from seven Detroit schools in a test for demonstrating their automotive technical know-how.

Teams of two boys each, using a minimum of tools and testing equipment, competed in trying to solve fourteen prearranged car maladjustments. Technicians and school instructors monitored each team.

George J. Cutler, Plymouth Service Director and originator of the contest, pointed to its value in helping to alleviate the existing shortage of trained service technicians by encouraging and assisting more young men to adopt the challenging and vital profession of automobile mechanics.

The contest emphasized that specialists are needed in hydraulics, steering, transmission, suspensions, etc., whose correct operation requires expert knowledge and skill in servicing.

Two teams tied for first place, each one making 14 mechanical corrections in their cars in just over 16 minutes. The champions were (left to right): Charles Joerin (age 17); Joe Sterbling (age 16); Jerry Price (age 17), and Alan Borlance (age 17). On extreme right, congratulating the winners, is Jim Mason, president of the Greater Detroit Plymouth Dealers Ass'n., sponsors of the contest.

When under pressure, nothing seems to go right. Here one contestant quickly stoops to retrieve fallen fender cover while teammate tries to solve the mystery of a plugged gas line. Tools were furnished by participants, but where needed, tool kits were loaned to contestants by The Snap-on Tool Co.

Automatic transmissions

A complete series of articles covering automatic transmissions — their design . . . how they operate, and how they are serviced. Be sure to read and keep all future articles for ready reference.

BY HERB CARRIER
Detroit Editor

Part IX—Servicing the Flash-O-Matic

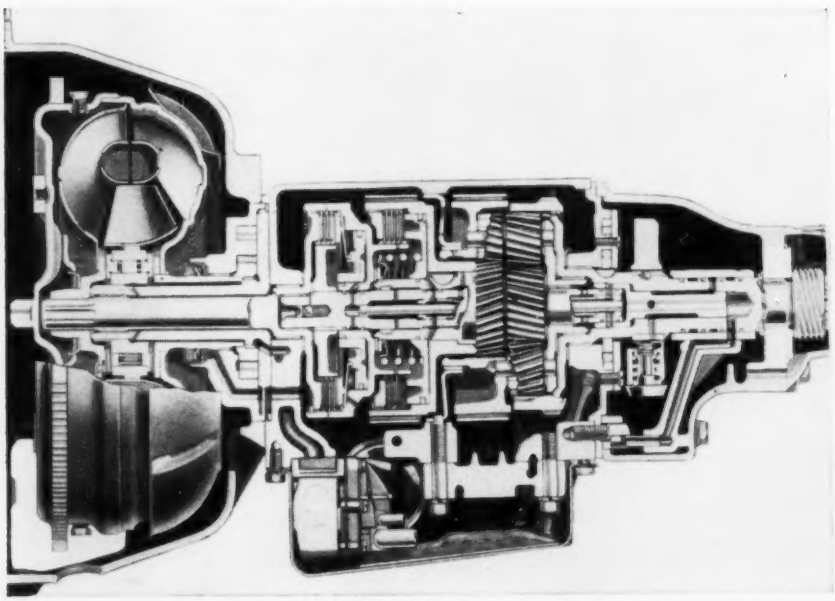
• AMERICAN MOTORS' Flash-O-Matic automatic transmission is somewhat unique in that the throttle valve pressure is controlled through a vacuum and solenoid unit. The vacuum control unit is located at the left rear of the transmission case, from which it is connected by a vacuum line to the carburetor. The shift pattern is controlled through the vacuum and solenoid unit calibrated with carburetor throttle opening.

Mechanically, Flash-O-Matic consists of a three piece torque converter, and a compound planetary transmission which is hydraulically controlled. The converter assembly contains an engine driven impeller, a stator connected to the transmission case through a free-wheeling unit, and a turbine which is splined to the transmission input shaft. The three units are enclosed in a fluid filled housing.

POWER FLOW

In operation, the impeller rotates with the engine and forces converter fluid through its curved vanes to the turbine. The turbine, with its vanes curved in a direction opposite to that of the impeller's, receives the fluid, absorbs energy from it, and begins to rotate in the same direction as the impeller. Because the turbine is splined to the transmission input shaft, turbine rotation is imparted directly to the transmission.

Fluid leaving the turbine passes to the stator, which redirects the fluid back to the impeller in the same direction as impeller rotation. This gives the impeller an added boost, and actually enables the converter to mul-



Flash-O-Matic Transmission consists of a three element stator, and a hydraulically operated automatic transmission. Mechanically, the transmission contains a front and rear clutch, a front and rear band (servo operated), and a compound planetary gear set.

tiply engine torque under certain conditions. At speeds below the coupling point, the stator is held stationary. This is because oil leaving the turbine strikes the stator blades at such an angle as to force the stator against the free-wheeling unit. Pressure against the unit is, in effect, against the transmission case. Therefore, the stator cannot rotate. At approximately the coupling point, oil leaving the turbine strikes the stator at an entirely different angle to cause pressure away from the free-wheeling unit. Pressure in this direction allows the stator to rotate with the whirling oil mass. At this point, the converter operates as an efficient fluid coupling.

The converter assembly is welded together in manufacture and cannot be disassembled for service. Any failure on the part of the converter will usually involve installing a new converter assembly. No attempt should be made to salvage a converter that needs internal repairs.

PLANETARY GEAR SET

Flash-O-Matic uses a compound planetary gear set to provide the necessary gear ratios to meet all driving conditions. The gear set consists of a primary sun gear, a secondary sun gear, primary and secondary pinions held in a common carrier, and an internal gear that is connected to the transmission output shaft. Power is transmitted through the transmission by holding and driving various combinations of gears.

As holding devices, a system of clutches, bands, and servos are used: a front clutch, a rear clutch, a front band, a rear band, a front servo, and a rear servo. The front clutch consists of a drum, three steel drive plates, four coated driven plates, pressure plate, piston, and seal. The steel plates are connected to the transmission input shaft. The coated plates are connected to the primary sun gear shaft. The plates are arranged in a pack so that there is a steel plate in between each two coated plates. This accounts for the four coated plates and only three steel plates.

In operation, the plates are pressed together by the clutch piston. The result of this action is to lock the primary sun gear to the transmission input shaft. Hydraulic oil under pressure operates the clutch piston, and the piston return spring releases the clutch when the hydraulic pressure is relieved.

The rear clutch consists of four steel plates, four coated plates, a pressure plate, a release spring, a piston, and a piston seal. The steel plates are connected to the secondary sun gear. The coated plates are connected to the front clutch housing. In operation, the clutch piston forces the clutch plates together to lock the secondary sun gear to the transmission input shaft. Hydraulic oil also operates the rear clutch piston, and the clutch return spring releases the clutch when the oil pressure is relieved.

SERVOS AND BANDS

Two servos are used to actuate the two bands. The front servo consists of a cylinder, piston, piston guide, release spring, and actuating link. The actuating link is in contact with the servo piston and the front band strut. When hydraulic pressure is directed to the *apply* side of the servo piston, it moves within the cylinder to apply the front band, which is mounted on the rear clutch drum. Applying the front band locks the secondary sun gear to the transmission case. To release the front band, hydraulic pressure is directed to the *release* side of the servo piston.

The rear servo is very similar to the front piston in construction and operation. However, the rear servo incorporates an accumulator and a release spring. The accumulator is used to cushion the application of the rear band, and the release spring returns the rear servo piston when the hydraulic pressure is relieved. In applying the rear band, the rear servo provides a means of locking the pinion carrier to the transmission case.

Installed in American Motors vehicles, the Flash-O-Matic makes a clean, compact unit. Note the lack of excess linkage and the vacuum and solenoid unit mounted on the rear of the transmission case near the extension housing.

PUSH BUTTON DRIVE

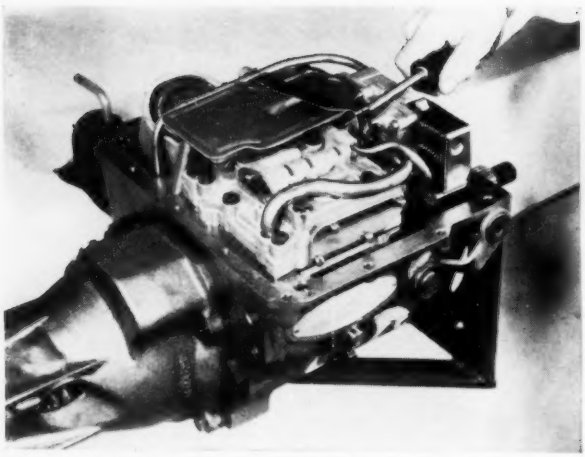
Gear ratio selection is made by the driver through a dash mounted selector control panel containing five push buttons: N (Neutral), R (Reverse), D-1 (Drive 1), D-2 (Drive 2), and L (Low). A separate Park lever is located on the dash panel directly below the push button control panel.

The parking lever operates a cable connected to the parking lever on the transmission case. When the lever is pushed *in*, a mechanical parking pawl engages the external teeth on the rear internal gear. This securely anchors the transmission power train to the transmission case so that the vehicle cannot be moved forward or backward.

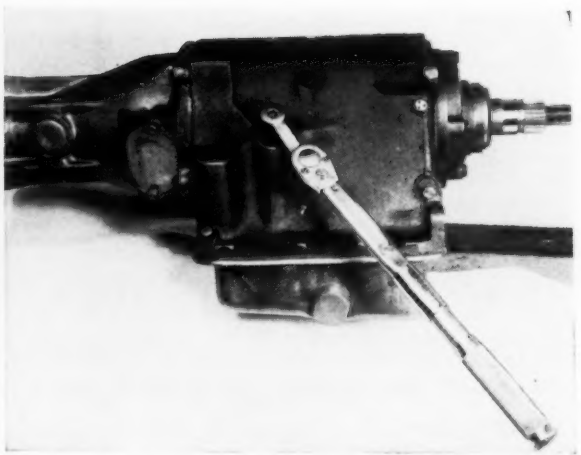
Additional mechanisms in the panel are arranged so

(Continued on following page)

Adjusting the front servo requires a special tool which includes a .250" gauge block. The tool has a special overrunning clutch which is used to obtain the right preload on the servo piston stem.



Removing the oil pick-up screen should be part of every front band adjusting procedure. It is not necessary to remove the screen for working clearance, but the screen should be carefully cleaned every time the transmission oil pan is removed.



The rear band can be adjusted without removing the transmission oil pan. Basically, the rear band adjusting tool is a torque wrench with a special adapter. Adjusting procedure calls for tightening the screw to 7 ft.lbs., then backing off screw 1½ turns.

Automatic Transmissions . . . CONTINUED

that when the Park lever is engaged, all push buttons except Neutral are locked and cannot be operated. Also located on the gear selector panel are two switches—a back-up light switch, and a starter neutral switch. If the starter neutral switch or the back-up light switch fail, and require replacement, they are held to the gear selector control unit by four prongs. After the selector assembly is removed from the dash, the prongs can be bent up with a screwdriver, and the switches removed. When installing new switches, care should be exercised in bending the prongs down, as it is possible to damage the assembly.

To adjust the gear selector push button control, disconnect the cable at the transmission lever. Push the N (Neutral) button *in*, and move the selector lever on the transmission all the way toward the front of the vehicle. Then set the lever into the first notch, which is Neutral. Adjust the cable to align holes in clevis and in lever. Install clevis pin securely, and check the adjustment in all five positions, N, R, D-2, D-1, and L.

SHIFT PATTERN

Power will flow through the transmission according to the units which are being held stationary. When the transmission is in neutral, none of the gear train members are held or driven. In all the other ratios, the pattern is as follows:

LOW—Front Clutch Rear Band	HIGH—Front Clutch Rear Clutch
INTERMED.—Front Clutch Front Band	REVERSE—Rear Clutch Rear Band

The only difference between the D-1 and the D-2 position s in the number of shifts the transmission automaticall makes. For example, in D-1 the transmission goes automatically through the entire three forward speeds. It starts in LOW, shifts to INTERMEDIATE, then shifts into HIGH. It also downshifts from HIGH to INTERMEDIATE then LOW. In the D-2 position, the transmission starts in INTERMEDIATE and shifts automatically into HIGH. Automatic downshifts are between HIGH and INTERMEDIATE only. All normal driving is usually done in the D-2 position. D-1 is available for added performance. A forced downshift is available for rapid passing, or for negotiating steep grades. Sudden floor-boarding of the accelerator pedal with the transmission operating in HIGH range will cause an automatic downshift into INTERMEDIATE. As the pressure is relieved from the pedal, the transmission automatically upshifts into HIGH.

BAND ADJUSTMENT

Band adjustment is accomplished by adjusting the servo units. To adjust the front band, remove the transmission oil pan, gasket, and screen after the fluid has been drained from the pan into a *clean* container. Loosen servo adjusting screw locknut, and back off screw two complete turns, working lever manually to determine if it operates freely. If lever is in good operating condition, insert the gauge block (.250″) between end of adjusting screw and servo piston rod. Using the special adjusting tool that incorporates an overrunning clutch, tighten adjusting screw until tool overruns. Remove gauge block and tighten locknut to 20 to 25 ft.lbs. If gauge block cannot be removed, loosen the screw one-half turn, remove block, and retighten screw one-half turn to original setting. Clean screen and pan in cleaning solvent, use new gasket, and install units carefully. Be sure to torque pan bolts to 10 to 13 ft.lbs. Refill transmission.

To adjust the rear band, loosen the adjusting screw locknut with the special adjusting tool. Tighten the screw to 7 ft.lb. torque, and back off the screw 1½ turns. Tighten the locknut securely. If any difficulty is experienced in locating the exact 1½ turn backoff, use a piece of chalk to make a reference mark.

VACUUM UNIT ADJUSTMENT

To provide a working adjustment of the vacuum control unit, locate the unit to a ⅜″ measurement between the transmission case and the front edge of the control unit. Connect a tachometer to the engine. Remove the ⅛″ pipe plug from the lower left front side of the transmission case, and install an oil pressure test gauge at this point. Start engine and place transmission in D-2. Apply service and parking brakes and accelerate engine to 1000 r.p.m. Correct oil pressure at this engine speed is 85 psi, plus or minus 5 psi.

If oil pressure reading is *not* within specifications, rotate the vacuum unit *clockwise to increase pressure*, or

(Continued on page 78)

40,000,000

car owners are being pre-sold on

INTERNATIONAL PARTS MUFFLERS

with Powerful Color Advertising in

The Saturday Evening POST

LIFE

NOW AVAILABLE...
2 NEW A-SIGNS

With International Parts Mufflers you have your choice of two attractive eye-catching A-signs. Both are embossed 3-color all-weather 6' metal signs. Sign #DS-11 is devoted entirely to International Parts Mufflers. Sign #DS-12 is a combination display featuring International Parts Mufflers on the upper half and 12 interchangeable services on the lower portion. Either sign will directly tie-in your service station or repair shop with International Parts sales stimulating national advertising program.

Be sure you display the A-sign they will be looking for.

International Parts Corporation

4101 West 42nd Place — Chicago, Illinois

West Coast Warehouse: Los Angeles 11 — *International Parts (Canada) Ltd., Scarboro, Ont.*

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"So you want to open a service shop?"

It's like leaving home to "go on your own" the first time. Here's "boot training" for the ex-salaried-employe embarking on the tossing seas of independent enterprise.

Part IV—Purchasing Equipment

By HERB CARRIER, Detroit Editor
and
DR. GEORGE A. FIELD, Wayne State University

• THE EQUIPMENT SITUATION in most automotive repair shops is somewhat like the rain situation down on the farm: For the boys who follow the plow, either there's not enough rain, or there's too much. For the average shop owner, either he constantly needs more equipment, or he already has more than he'll ever need.

Ordering the tools of his trade is one of the major problems that confront an independent shop owner. Careful analysis is vital if the buyer is to get the right amount of equipment at the right price, and financed—if necessary—at the most favorable rate of interest.

ITEMIZE NEEDS CAREFULLY

In digesting equipment needs, it's almost mandatory that you compile a comprehensive list. No doubt, as a working mechanic you'll have most of the hand tools necessary for your business, but the equipment that heretofore the employer has furnished will have to be purchased. This will bring to light some of the things that are taken for granted, or ignored by even the most appreciative employee.

There will be things on the list like order desks, filing cabinets, chairs, fans, clothing lockers, hand towels, etc. Plus, of course, the major equipment items. A want list, if it is to be of any real value, must include *all* items that must be purchased in order to operate your business in the most efficient and profitable manner.

As an aid to compiling equipment lists, you can buy booklets from the United States Government Printing

Make a list of equipment you think will be necessary for you to open your doors. Then visit other shops and compare it against their inventory . . . as well as seek the advice of your equipment suppliers.

Take time to visit shops similar to yours, noting in particular if certain equipment shows evidence of not being used. This will help you in making final decisions on what you will or won't need.

Office, Washington, D. C., or from the U. S. Department of Commerce. These booklets, which list all the tools and equipment needed for your type of business, usually cost 25 cents each, and are extremely valuable in the early planning stage of any small business.

LOOK IN ON OTHER SHOPS FOR IDEAS

Working with a prepared list is a good idea in other ways. For example, it is much easier to cross items off the list which are not required in your particular specialty than it is to write a list off the top of your head—you'll overlook many items if you try. You can, however, prepare a good list by visiting similar businesses and listing their tools and equipment. When making such visits, spend a few minutes with the men working in the shops. Ask them what items they have that they don't really need, also ask them what equipment they would *like* to have. Be sure, though, that they understand you aren't selling anything. Glance around during the conversation to see if there are things in the corners gathering dust. Ask the garage owners which pieces of equipment are their best money makers. Don't be nosey, but show a sincere interest, and quite likely you'll receive a sincere answer.

Another good source of finding out exactly what you'll need in the way of equipment is to ask the equipment supplier. Heaven knows he's ready and willing to sell you all the items you'll ever need. Most are reputable businessmen, and will steer you straight rather than try to force merchandise down your throat. Suppliers can also render valuable service in suggesting general shop layouts. In their business, they visit many shops and, consequently, are in a position to make intelligent recommendations—especially when it concerns the use of their products.

ESTABLISH CREDIT

Very few people establishing a business can afford to go all the way with cash. Even if they could, it's not always a sound business policy. Good credit is an extremely valuable asset. In most every case, it will pay to get your credit established early in the game.

As with everything else, the intelligent borrower does intelligent research *before* he actually borrows the money.

Among money lenders, money is a commodity which is rented out, and the rates they charge for the use of their money varies. In the main, Usury Laws guard the public against illegal interest rates, but interest rates can vary enough to make shopping around very worthwhile.

In some cases, banks have lower interest rates than the finance companies. In other cases, it's the other way around. *Always,* it's the borrower's responsibility to shop for the best deal.

Major equipment can often be financed directly by the manufacturer, distributor, or jobber. This will bear investigation to see how their rates compare to companies whose business is loaning money.

COMPUTING LOAN INTEREST RATES

In researching terms of borrowing money, watch especially the interest rates. Interest, of course, means the rental fee on the money, and money lenders usually quote the "nominal" rate of interest. This, however, can be misleading. When accepting the nominal interest rate as the actual rate, it's not unusual to find yourself paying considerably more interest than you think you are.

If a company quotes interest on the total amount due, you can make up your mind that the actual rate of interest is much higher. A simple bit of arithmetic can show you just how much higher. There are several formulas which can be used to compute the actual rate of interest on short term loans. One such formula is:

$$R = \frac{r^2\,(2N)}{N+1}$$

This applies when R is the actual *annual* interest rate, r stands for the nominal or quoted interest rate, and N represents the number of installments. If your Algebra is good, you can apply this formula to find the actual interest rate on a loan when the interest rate is quoted on the entire amount borrowed, even when payments of that amount are made regularly.

Another formula often used says: $R =$

$$\frac{2\ (\text{payment periods in year}) \times (\text{total finance charges})}{(\text{original unpaid balance}) \times (\text{number of payments} + 1)}$$

These formulas will indicate the difference between

(Continued on following page)

Opening A Shop? . . . CONTINUED

actual and quoted interest rates. To get an idea of just how much difference can exist between the two, a quoted interest rate of 10% can actually figure out to be 18%.

You see, it really pays to investigate before you borrow. If mathematical formulas aren't up your alley, simply figure out how much you would have to pay per month in order to pay off your loan with no interest. You can do this by dividing the amount of the loan by the number of months you have in which to pay the money back. Then, subtract this figure from the amount of the actual monthly payment. Multiply the result by the number of payments, and you will see just how much it will cost to borrow the money for the length of time you want it.

Your equipment suppliers can be a big help to you in formulating shop plans and suggesting equipment necessary for servicing automobiles at a profit.

There are other considerations when borrowing money. Don't concern yourself so much with the rate of interest that you forget other important items. Watch closely for the item marked "service charge." Find out just exactly what it means. Some times such charges are designed to cover the cost of investigating the borrower's credit standing. At the most, this checking procedure involves a few local telephone calls. Yet, the borrower may be charged for this "service" to the tune of 25 to 50 dollars.

Find out, too, just what will be the loan company's recourse if you find yourself unable to live up to the terms of the contract. Some companies love chattel mortgages. If you stand still for it, they'll slap a lien on all your worldly goods, including your wife and children. Make sure you can't be held liable for more than the actual amount of the loan.

It's customary in some cases for suppliers to finance customers by extending credit on the merchandise they buy. Generally, such credit deals are very good. The amount they extend tends to be related to the normal turnover rate of the item. For instance, heavy equipment can be financed over a long period of time, but fast moving parts can be financed for only a much shorter period.

Most trade credit plans offer a cash discount for prompt payment. On the surface, this may look quite trivial because it only amounts to one or two percent. But figure that a 2% discount for payment in twenty days equals 36% per year on your money. This means, naturally, that you can save $36 out of every $100 involved if you meet your trade credit payments on time. To double check on this, figure that 20 days equals one-eighteenth of a year.

PARTS STOCK

Depending upon the kind of automotive repair business you go into, your stock of replacement parts may be large or small. A large general repair shop, for instance, will necessarily have to carry an extensive parts inventory for both its own use, over-the-counter retail sales, and for wholesale business. On the other hand, a small front-end shop might limit its parts supply to fast moving front-end parts only.

Generally, one square foot of the total building floor space should be devoted to storage for every $10 worth of parts inventory. This is figuring the parts at cost, not retail selling price. If a large inventory is expected, considerable planning should be given to laying out the parts department.

Because most new businesses in the automotive repair field are necessarily small independent enterprises, not too much time will be spent discussing extensive parts department layout and operation. However, any garage, no matter how small or how specialized, will have to stock some replacement parts. The best way to handle this is on a consignment basis. This is real good for the retailer—you—because you pay nothing until the parts are sold. You can't lose—no sell, no pay.

The parts supplier isn't too worried about your failure to push parts, though, because this is where you will make a considerable part of your profit. If you don't aggressively merchandise parts, you'll seriously hamper your income potential.

In stocking parts on consignment, have a clear understanding about who carries the insurance on the parts

inventory. It can be embarrassing if fire breaks out in your shop and you find yourself liable for several thousand dollars' worth of worthless parts. Be certain they are insured. If at all possible, make the supplier carry the insurance, and make him prove to you that they are insured. This isn't always possible, but it's worth a try.

Even though parts accepted on consignment are no-risk items that many operators consider practically free, don't go overboard and stock too much. There are several reasons why this is not advisable. First, and most important, storage space costs money. Second, parts are classified as tangible inventory and, as such, they are taxable under certain laws. You may be able to sneak around the tax by making the supplier claim them on his inventory, but this can be risky. It's much better to limit your inventory to parts you actually need. In a good operation, parts will turn over about four times a year. Six times a year is ideal, but the national average is about two. With these figures in mind, and after the experience of a few months in business, you can estimate your parts sales with reasonable accuracy.

QUALITY IS ALL-IMPORTANT

Above all, *don't buy or sell inferior goods.* Second-rate parts are all too common. Counterfeit and reject parts can be attractive because of the unusually high mark-up, and, unfortunately, these parts are sold all over the country. Some even are posed as first-class merchandise. By all means, stay away from suspicious goods. One dead or injured customer—or alive and hollering—makes very poor advertising, especially since your ultimate success will depend upon your neighborhood reputation. Handle only good parts with a good guarantee, and select your supplier carefully. He'll actually be in business with you.

Automotive Ad Council Elects 1958-59 Officers

During their recent annual meeting at Hot Springs, Va., members of the Automotive Advertisers Council

New AAC officers are (left to right): Lester C. Dobrunz, Wagner Electric Corp., vice president; Frank F. Schuhle, General Electric Co., Miniature Lamp Dept., president; M. Robert Wolfson, Maremont Automotive Products, Inc., treasurer. Standing: Albert Joseph, The AP Parts Corp., corresponding secretary; Robert C. Calderone, Raybestos Div., Raybestos-Manhattan, Inc., recording secretary.

(AAC) elected officers for the 1958-59 term.

The AAC, composed of advertising representatives from the major automotive replacement parts companies, meet twice yearly to discuss mutual problems.

Tune-Up Facts and Figures

The next time a customer "balks" at the idea of investing in a tune-up for his car, throw him a few of these statistics, as compiled by the Champion Spark Plug Co.

If he drives the average 10,000 miles per year, his spark plugs probably fired some 15 million times since their last replacement. The carburetor may have mixed as much as 700 gallons of gasoline with over 6 million gallons of air.

The distributor points have made contact about 15 million times while the water pump has circulated the equivalent of about 150,000 gallons of water.

Meanwhile, each piston will have traveled over 3,000 miles up and down inside the cylinder.

Willys FC-150 Overheats

Should a serious case of engine overheating be encountered on a Willys Model FC-150, the factory recommends checking the upper tank of the radiator for a baffle between the inlet and outlet connections. A wire probe may be used to detect the presence of the baffle. If the baffle is missing, it is recommended that the radiator be replaced.

The baffle directs the flow of coolant down through one side of the radiator core and up the other side. If the baffle is missing, the coolant will flow from the intake to outlet without flowing through the radiator core.

If You Want To *Sell*, You've Got To *Move!*

By Larston D. Farrar

Beware the deadly sitting habit
Or, if you sit, be like a rabbit
Who keepeth ever on the jump
By springs concealed beneath his rump.

A little ginger 'neath the tail
Will for a lack of brains avail.
Eschew the full and slothful seat
And move about with willing feet.

Man was not made to sit in trance
And press and press and press his pants,
But rather with an open mind,
To circulate among his kind.

And so, my friends, beware the snare,
That lurks within the cushioned chair.
To run like hell, it has been found,
Both feet must be upon the ground!

From *How to Make $18,000 a year Free Lance Writing:* Hawthorn Books, Inc., New York City; $4.95.

Salih Receives His Second Winning Mechanic Award

George Salih of Whittier, Calif., the chief mechanic on Jimmy Bryan's winning car at this year's Indianapolis 500 Classic, was recipient of a cash

George Salih (center) looks over the Black & Decker Valve Shop, one of his awards as "winning mechanic" in this year's "500" Speed Classic. Also shown are J. T. Redmon (left) B&D Indianapolis district manager, and Jimmy Bryan, who drove the winning car this year. This is the second straight win for George, whose car driven by Sam Hanks, was first over the finish line in '57.

prize of $1200 plus a diamond studded pin awarded by Wynn's Friction Proofing. This makes the second year Salih has won the coveted Wynn's award—Bryan's car (the Belond AP Special) was built by Salih and is the same car Sam Hanks drove to victory in the 1957 race.

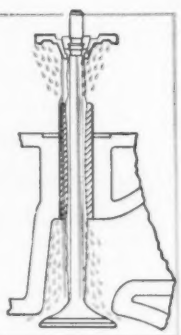
Also honored at the Victory banquet was Dick Rathmann, who won the pole position with a qualifying time of 145.974 m.p.h. For his efforts, he received Wynn's "Rex Mays Award" —a gold wrist watch.

To make your shop more profitable . . . your time more valuable . . . be sure to read this month's "These Are New" section

NOW! STOP OIL THROUGH

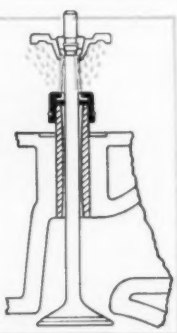
THE PROBLEM

The high intake manifold vacuum that occurs during deceleration and the vacuum normally created at the lower end of valve guides by the rapid surge of gas creates a low static pressure...an atomizing effect...during intake and exhaust strokes. This drains oil through the valve guides and into the manifolds.



THE SOLUTION

The Perfect Circle Valve Seal is shown here installed on a typical overhead valve. The contracting Teflon oil control ring functions very much like a piston ring. It keeps the atmospheric pressure and oil in the rocker arm chamber from equalizing with the vacuum in the manifold. The contracting force of the ring on the valve stem prevents passage of air or oil between the stem and guide, but distributes and leaves a very thin film of lubricant on the valve stem.



New Perfect Circle development solves problem common to today's overhead valve engines

Do you ever wonder why an engine continues to burn oil even after an apparently competent overhaul job—complete with new rings?

The answer may be found in oil loss through the *valve guides.* As you know, automotive engineers turned to OHV design in their quest for higher and higher horsepower even though it was known that a penalty might have to be paid in the form of oil loss through valve guides.

That disadvantage of OHV design became more serious year after year as compression ratios soared and as "deceleration vacuum" became more of a factor. In fact, quite often with worn overhead valve engines more oil is

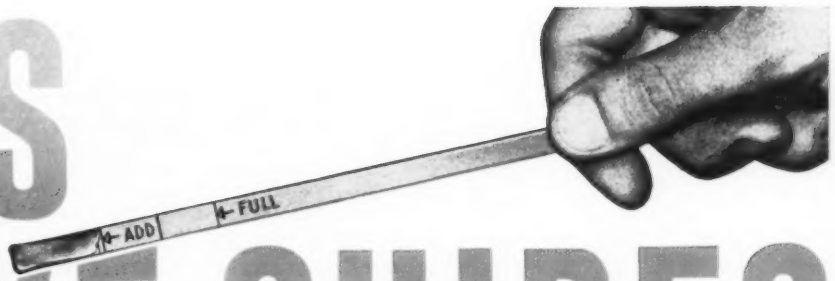
EASY TO INSTALL

...the only special tool that may be required is a valve guide cutting tool.

PERFECT CIRCLE

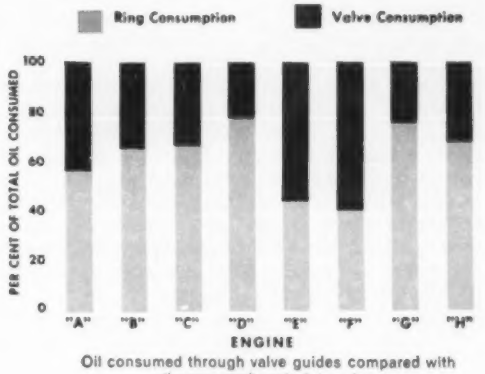
Perfect Circle Corporation, Hagerstown, Indiana;

LOSS VALVE GUIDES



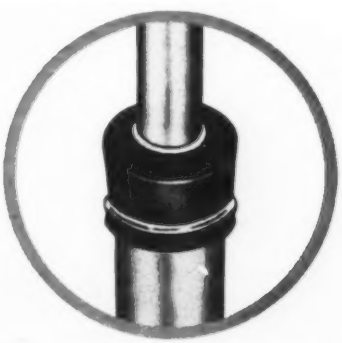
lost through the valve guides than past the pistons. See chart.

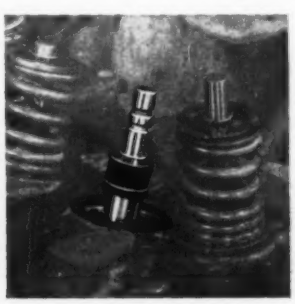
Today there is a simple, positive solution to the problem—Perfect Circle Valve Seals. Developed by Perfect Circle engineers after years of research and testing, the Perfect Circle Valve Seal was further refined through collaboration with the engineers of interested engine manufacturers. Perfect Circle Valve Seals are easy to install and are low in cost. They are now available for popular makes of cars.



Oil consumed through valve guides compared with oil consumed past piston rings

Perfect Circle Valve Seals are now available for popular makes of cars. See your jobber for the latest list of cars for which PC Valve Seals are available.





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Where does the power go?

Rated engine horsepower is not all available to propel the motor vehicle because the transmission, fan, water pump, air compressor, wind resistance, friction and other factors are eager to take their "cut."

By GUY F. WETZEL
Technical Editor

• WHEN WE LOOK over the specifications of the late model automobiles, we see that the rated horsepower runs from around 145 for popular makes of six-cylinder engines to 360 for current V-8 engines.

All of these horsepower ratings are the maximum power, as shown on the horsepower curve based on dynamometer tests, and occur at certain speeds which may range from 3600 r.p.m. for popular sixes to 4800 r.p.m. for the bigger V-8 engines.

Rated horsepower should not be taken at face value, however; for an engine rated at 225 hp., for example, actually may show up considerably less than 200 hp. on the road. This discrepancy exists because test engines often are completely stripped of accessories while undergoing horsepower output tests.

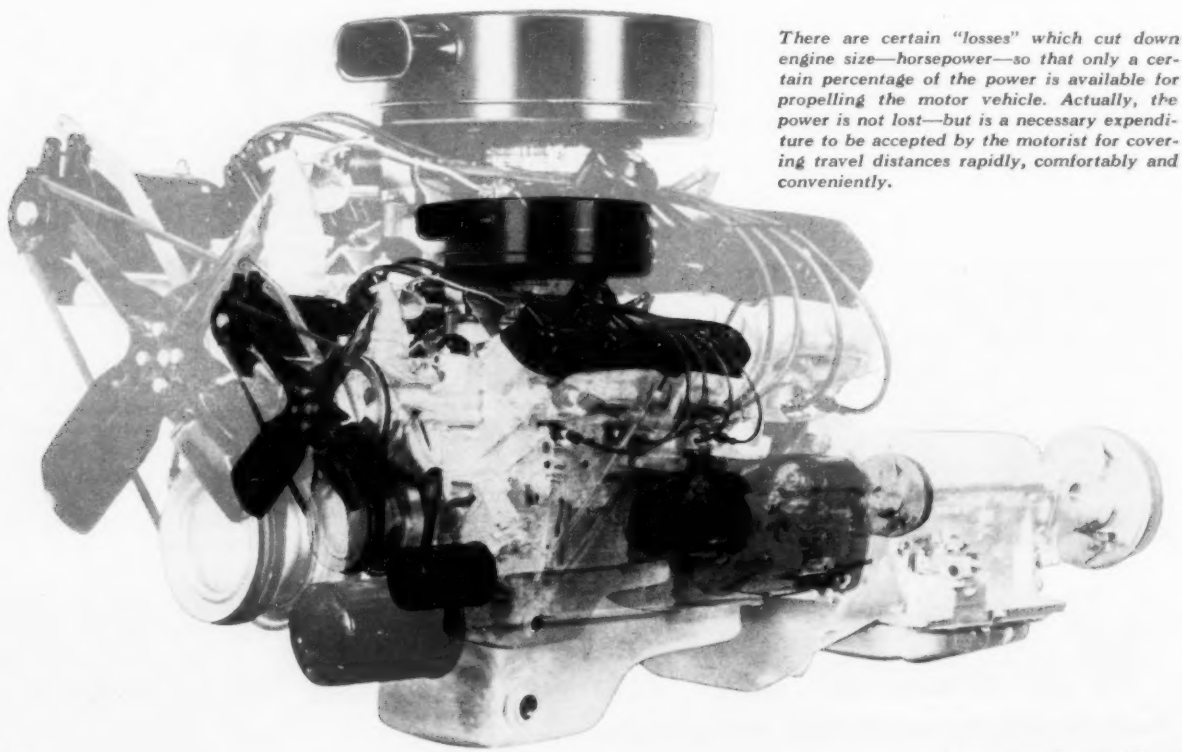
For example, there is no fan, air cleaner, muffler, accessories (like air conditioning, compressors, power steering pumps, etc.), all of which add considerable horsepower losses to the car's final power characteristics on the road.

WHAT DO RATINGS MEAN

Now, an interesting question is: "What do these horsepower ratings actually mean?" The engine being the source of power in the car must deliver ample power to drive the vehicle at varying speeds and load conditions. The natural assumption is that the rated horsepower is available for propulsion, but this is *not* the case.

In the first place, we must remember that one factor in measuring engine power output is "speed". Therefore, an engine that will deliver 200 hp. at 4800 r.p.m., for example, would deliver only 100 hp. at 2400 r.p.m., disregarding other conditions for the present.

In the second place, the power rating is generally developed from tests on a "bare engine" with wide open throttle (WOT). By bare engine we mean an engine with (1) no air cleaner, (2) no generator, (3) no engine fan, (4) spark and fuel adjusted to give best power at each speed (by steps of 200 r.p.m.), (5)



There are certain "losses" which cut down engine size—horsepower—so that only a certain percentage of the power is available for propelling the motor vehicle. Actually, the power is not lost—but is a necessary expenditure to be accepted by the motorist for covering travel distances rapidly, comfortably and conveniently.

no exhaust heat to intake manifold, (6) exhaust system in dual piping from exhaust manifold to evacuated laboratory exhaust system with back pressure not less than atmospheric or more than 1" Hg pressure (mercury pressure). The power required by the water pump and the fuel pump is included in the bare engine horsepower, as these units are on the bare engine as it is tested.

The results of a bare engine test are corrected for atmospheric variables such as barometer, vapor pressure and temperature, in accordance with the procedures set up by the Society of Automotive Engineers. These factors are quite important, as the normal day to day variation in humidity and barometric pressure alone can produce variations in engine output by as much as 10%.

To analyze the application of engine power it will help if we have a definite engine to refer to. Therefore, let us assume a V-8, OHV engine of 200 hp. at 4400 r.p.m., with 300 cu. in. displacement, and 8.5:1 compression ratio. Such an engine is comparable to our present-day, volume-produced V-8's.

WHERE POWER IS CHANNELED

When an engine is taken off the test stand and put into an automobile, its power begins to go into a number of channels other than propelling the vehicle. For example, with a dual muffler system and engine running at 4400 r.p.m. with wide open throttle, there will be a power loss amounting to 7%, diminishing down the speed range. With a single muffler the loss will jump to 14% at 4400 r.p.m., WOT.

The air cleaner requires a certain amount of power to draw the required air through it, and this will amount to 3% at 4400 r.p.m., WOT, diminishing down the speed range.

Combustion chamber deposits will be responsible for a loss in power output, which averages about 4% over the entire speed range.

The manifold heat riser will absorb a maximum of 5% at 1600 r.p.m., dropping down to 1% at 4400 r.p.m.

The automatic distributor (with vacuum and automatic advance) will account for 6% at 800 r.p.m., varying down to 1% at 4400 r.p.m. The total of the items mentioned is 16% at 4400 r.p.m. Thus we have lost approximately one-sixth of the engine power output even before any accessory units are driven.

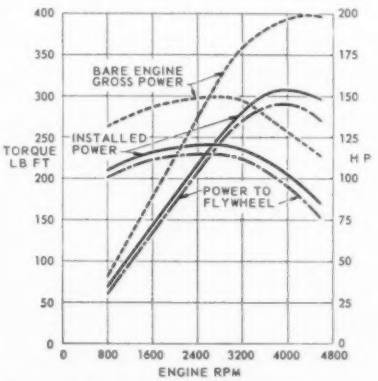
AUXILIARY EQUIPMENT NEEDED

The engine cannot function as a self-contained power plant without some auxiliary equipment, which will take a further bite out of the available engine power at the front end of the crankshaft. For the purpose of this analysis, we will only consider the fan, the generator and the power steering pump (if so equipped). The first two have been required on engines for many years; the power steering pump is rapidly becoming standard because of the demand by car buyers—and the engine has to drive these accessories.

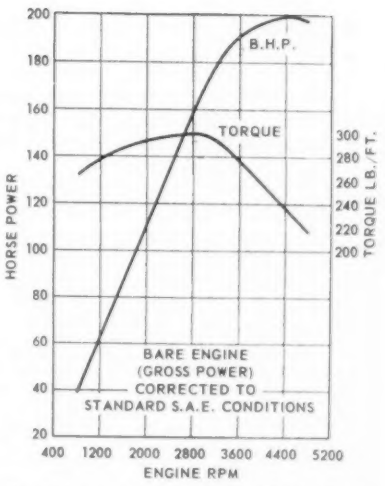
FAN TESTED SEPARATELY

The fan, requiring more power than either of the others, is a necessary part of the power plant, since its function is to help engine cooling, accomplished by drawing air through the radiator and blowing it back over the engine. Engines were tested years ago with the fan installed, so it was unnecessary to run separate fan tests to determine their power requirements. The fan power was automatically deducted from the gross developed engine power. But because of the accident hazard to testing personnel, noise, and the desire to rate engines as high as possible, fans are now left off during the rating tests, and are tested separately on a small accessory dynamometer.

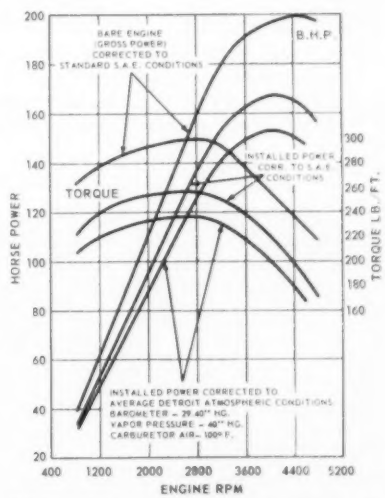
The amount of fan power needed is affected by grille styling, by the amount of heat to be carried away by the air stream, radiator efficiency, and —most important—the fan efficiency itself. The power required by the fan varies as the cube of the speed. Therefore, at 4000 fan r.p.m. it will require eight times as much power as at 2000 r.p.m. At 2400 engine r.p.m., the fan on the engine being considered will take 1.0 hp. which will increase to approximately 2.4 hp. at 3200 r.p.m. and to 7 hp. at 4600 engine r.p.m.



Power and torque curves showing the bare engine, engine power as installed, and power delivered to flywheel when the fan, generator and power steering pump are driven. Under the most favorable conditions there is only 145 hp. available at the flywheel on this engine.



Typical power curve showing brake horsepower (BHP) and torque in lb./ft. for the hypothetical engine referred to in this article. Shown is the generated power on the bare engine.


BARE ENGINE (GROSS POWER) CORRECTED TO STANDARD S.A.E. CONDITIONS
B.H.P.
TORQUE
INSTALLED POWER CORR. TO S.A.E. CONDITIONS
INSTALLED POWER CORRECTED TO AVERAGE DETROIT ATMOSPHERIC CONDITIONS
BAROMETER – 29.40" HG.
VAPOR PRESSURE – 40" HG.
CARBURETOR AIR – 100° F.
HORSE POWER
TORQUE LB. FT.
ENGINE RPM

BHP and torque curves for three conditions in an assumed engine: (1) the bare engine, with 200 BHP; (2) the engine installed in a car with power lost through muffler, air cleaner, manifold heat, automatic distributor and combustion chamber deposits, and (3) the installed values corrected to average atmospheric conditions, showing maximum horsepower to be approximately 152 at 4000 r.p.m.

POWER REQUIREMENTS VARY

The generator, which supplies the electrical needs of the car, will have varying power requirements, depending on the need for current by the lights, ignition system, radio, heater and defroster fans, power windows, and other electrical accessories that may be added by the owner. Typical of rotating electrical apparatus it has its own cooling blower which adds

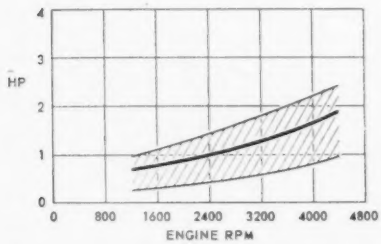
(Continued on following page)

Horsepower . . . CONTINUED

to the load. For average use, the generator will put out about 2/3 of its peak requirement. The power needed on this basis will vary from about .75 hp. to almost 2 hp.—which is another appreciable bite out of the engine's power output.

The third accessory on a substantial proportion of late model cars which draws power from the engine ahead of the flywheel, is the power steering pump. The pump requires power in proportion to the load placed upon it. It may idle along, taking care of the friction losses of the system, or really go to work when turns are made. It is required to instantaneously provide pressures as high as 700-800 p.s.i. Most of its work is done at low car speed while parking or turning corners. The power requirement will be from about .25 hp. to a little over 2 hp. at 4000 engine r.p.m.

At 50 m.p.h. the power demand of the accessories is relatively low, amounting to 2 hp. But when speeds get up to the range of the horsepower peak, the 200 hp. we had at the beginning drops to 145 hp. available at the flywheel. Thus over 25% of the gross rated power of the engine has been used up in the area ahead of the



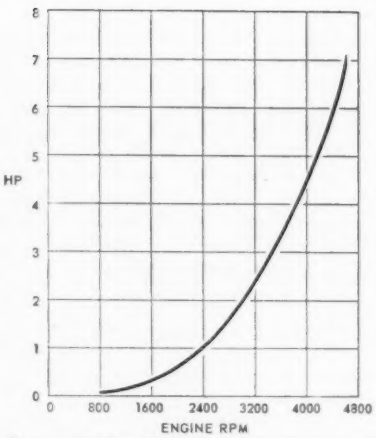
Generator power input varies considerably, depending on driving conditions. The upper and lower curves, enclosing the shaded portion, show the variations in power. The heavy line in the middle represents average use of the generator.

flywheel with no power as yet applied to driving the car.

AIR CONDITIONER TAKES ITS SHARE

Air conditioning, especially in the south and southwest portion of the country, is an accessory which is becoming increasingly popular. Since this is a system which appreciably affects engine power, it requires careful consideration.

Power is needed in three ways on air-conditioned automobiles: (1) to operate the refrigerant compressor; (2) to operate the air conditioning system air circulating fan or fans, and (3) the larger engine fan which is required to pull air through the air conditioning condenser (usually



Curve showing the power requirements of the fan. The power varies as the cube of the speed and rises rapidly as speed increases.

located in front of the engine radiator), as well as through the engine radiator.

The power used by the compressor is moderate in amount at low engine speeds (2 hp. at 800 r.p.m.) but this increases to approximately 8.3 hp. at 4000 r.p.m. In addition, at 4000 r.p.m. the larger fan required for air conditioning installations uses around 2 hp. more than the standard engine fan at 4000 r.p.m. This amounts to a total of 10.5 hp. more than on cars without air conditioning.

And while on the subject of compressors driven off the fan pulley, let's not overlook the air compressor required for operating air suspension systems which made their debut on many of the 1958 models—which obviously means additional loss in engine power.

THE POWER TRANSMISSION

The internal combustion engine can be considered as a fairly constant-torque power unit, with practical limits on its lowest and highest operating speeds. Between these limits the power developed by the engine is almost proportional to its speed. Maximum power is developed at high engine speeds.

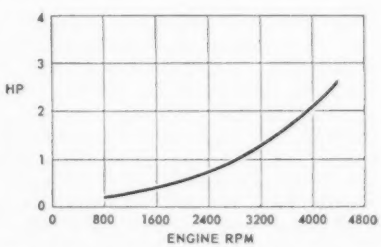
The automatic transmission combines with the engine to provide the operator with high engine power over a wide range of speeds for acceleration and/or hill climbing, merely by depressing the accelerator.

This unit is a vital and efficient piece of equipment, but we do not get the benefit of its operation without paying for it through consumption of additional power.

From the original 200 rated hp. in the engine we are considering, the accessories have reduced it to 145 hp. The output horsepower from the transmission will be approximately 135 hp. at 3800 output r.p.m. in direct, 131 hp. at 2600 output r.p.m. in second, and 127 hp. at 1600 r.p.m. in low gear. These values, which represent the peaks, figure out to be 93%, 90% and 87% respectively, of the input horsepower.

With the standard manual-shift transmission, having ratios of 1.60 and 2.55 for second and first gears, with high in direct, the power delivered to the propeller shaft would be 143.8 hp. at 4000 r.p.m. in high, 141 hp. at 2400 r.p.m. in second, and 137 hp. at 1500 r.p.m. in first gear. In percent of input horsepower, these values represent 99%, 97% and 94.5% respectively, indicating that the manual transmission is quite efficient, though it does not give the flexibility in power application of the automatic transmission.

In the automatic transmission the power losses are considerably higher, amounting to from 10-18 hp. at maximum power. At low speed the losses may be even higher. However, from the standpoint of effectiveness, the automatic transmission gives better performance at normal operating speeds and smoother, quieter cruising. This is true because the automatic transmission allows the engine to develop more power at low and



The variations in power required to operate the power steering pump. For example, at 4400 r.p.m., the power needed is 2½ hp.

moderate speeds so it is possible to deliver more useable power to the driveshaft, even though the efficiency is lower. The expenditure of a little added horsepower in the automatic transmission pays dividends in the way of better car performance.

OTHER POWER LOSS FACTORS

We have considered power losses or power consumption in front of and behind the flywheel of the engine, but have not taken into account the losses in the rear axle. Also, there is the power required to overcome wind and rolling resistance to car movement.

Consider the axle ratio on the theoretical car we have been analyzing to be 3.2:1. The rear axle efficiency will approximate 95% to 97% under

(Continued on page 76)

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Where seeing is believing

Dramatic demonstration of variable engine performance factors on a trouble-simulating test engine impresses mechanics with the importance of accuracy in analyzing the various factors which influence spark plug operation.

By HERB CARRIER
Detroit Editor

● RECENTLY THE WRITER had an opportunity to attend a get-together at the Father and Son Garage, Detroit, Mich., where a dramatic and impressive demonstration of variable engine performance factors was conducted by Robert E. Dale, Champion Spark Plug Service Engineer. The audience was made up of IGO members from the Detroit area, headed by Pierce R. Butler, Executive Director, IGO-Michigan.

The demonstration, which included the use of a portable, one-cylinder, air-cooled, four-stroke cycle engine, was part of Champion Spark Plug Company's program of bringing the spark plug story directly to the people at work in the field. Since 1956, there have been 587 such meetings held before an audience of approximately 42,000 people. Champion has ten men trained to conduct the demonstrations. In addition to programs in the United States, Champion conducts similar meetings in England and in Canada.

NEED EXISTS FOR PLUG KNOW-HOW

As Mr. Dale pointed out, modern high-performance engines are creating new standards of power output and over-all efficiency. These improvements are made possible by many factors—Stepped up compression ratios, higher octane fuels, improved carburetion and "breathing", better materials, and increased engine speeds.

Because of this trend, spark plugs and other engine components are now operating under much more severe conditions. Thus, spark plugs have to be much more carefully selected and engines have to be correctly adjusted to obtain the full measure of performance built into them.

PLUG HEAT RANGE

Spark plug engineers carefully tailor plug design and operation to individual engine requirements. One of the more important aspects of a spark plug is its heat range, which, as most every mechanic knows, is the ability of the spark plugs to carry heat away from its firing ends. A "cold" plug is one that carries heat away quickly. A "hot" plug takes considerably longer to transfer heat away from the firing tip.

The cold plug can easily be determind by its short insulator nose. This design enables the heat to quickly travel the short distance to the cooling surfaces. Such a plug is used under heavy-duty operation to avoid overheating and possible pre-ignition.

The hot plug has a much longer insulator nose, and, therefore, runs at considerably higher temperatures. This is desirable when the extra heat can be used to burn off combustion deposits which might tend to foul the plug when the engine is operating under light loads or prolonged periods of idle.

All spark plugs must operate between the same temperature limits in order to avoid fouling or burning. This range is usually thought of as being roughly between 700° F. at the low end, and 1700° F. at the high end. Below 700° plugs are apt to foul out because carbon and oil deposits may not be burned away. Above 1700° the plug may remain hot enough to cause pre-ignition, which means, of course, the fuel-air mixture will be ignited before the plug actually fires.

TEMPERATURES SHOWN ON SCREEN

In the Champion demonstration engine, this fact was clearly illustrated on a large movie screen. Through a unique projection arrangement, thermocouple spark plugs (a special spark plug developed by Champion engineers to record actual operating temperatures of spark plugs) of different heat ranges were used alternaterly in the engine and their operating temperatures flashed on the screen.

Robert E. Dale, Champion service engineer (left), runs over the evening's program with Pierce R. Butler, executive director of the IGO-Michigan. Note elaborate equipment necessary to carry out the demonstration.

Hosts for the evening were Ernie and Harold Cyr, seated in the first row second and third from the right.

It was apparent to all who were present that the temperature curves of the "hot", "normal", and "cold" plugs were decidedly different. In this particular engine, only the "normal" plug operated in the 700° to 1700° range. Through this type of presentation, it's possible to actually *see* the effect of using plugs of the *right* and *wrong* heat range. It was certainly a living example of the old adage about one picture being worth a thousand words.

SPARK PLUGS CAN BE "READ"

While it's not practical to install thermocouple plugs in every engine to determine which type of spark plug it requires, it is possible for the mechanic to "read" the used plugs which have been removed from the engine and thereby gain a knowledge of the heat range requirements of any particular engine.

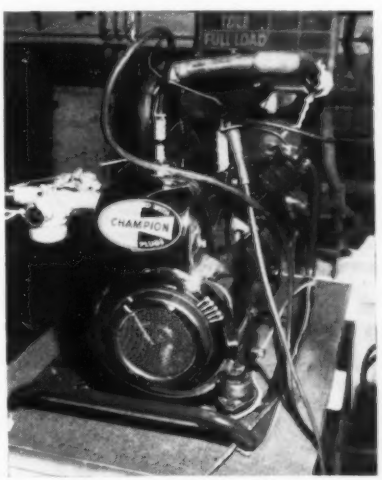
Usually, there are only four definite spark plug conditions: normal, carbon fouled, oil fouled, and overheated. Naturally, there are indefinite variations of these conditions, but, generally speaking, these four groups represent the most common forms of spark plug failure.

A normal spark plug, one suitable for operating in the engine from which it was removed, will have an insulator that is light tan or brown in color, and a minimum amount of combustion deposits. A normal plug also increases electrode gap at the rate of .001", or less, per 1000 miles of operation.

Carbon fouled plugs are heavily coated with thick, black, flaky, carbon. This indicates that the plug is of improper heat range for the engine because it is operating at temperatures somewhat less than the minimum of 700° F. Care should be taken when recommending hotter plugs for this condition as it is sometimes possible for an over rich fuel-air mixture to cause the same fouling. If however, the exhaust gas analyzer indicates that the carburetor is set properly, yet the plugs carbon foul, don't hesitate to install new spark plugs of the next hotter heat range.

Oil fouled plugs can be due also to plugs which operate too cold. This condition is aggravated by excessive oil entering the combustion chamber passed worn rings, cylinders, pistons, or valve-stem guides. The general cure in this case is to install hotter plugs which will tend to burn off the oily deposits. Seriously worn engines, however, can only be helped so much. A hot plug cannot stop oil burning, but it will lengthen the period between spark plug cleanings.

If oil fouled plugs are discovered in a new engine, *do not* install hotter plugs. Because of the short-stroke design, and the skuff-proof piston rings, it's not unusual to find an engine only partially broken-in after several thousand miles. This is especially true if the car is driven mostly in heavy traffic which prevents proper "exercising" of new engines. When plugs become oil fouled under these conditions, it's best to clean, adjust, and reinstall them. Do this until the engine is thoroughly broken-in. Then, an accurate analysis can be made to determine the plug heat range suitable for the engine and the owner's driving habits.



The demonstration engine is equipped with dual carburetors for running on low or high octane fuel. Special thermocouple spark plugs provide means for recording plug operating temperatures.

An overheated or burned spark plug can be identified by the scorched, burned appearance of the insulator firing end. This type plug will also have an unusually wide gap in relation to the amount of mileage it has been driven. Normally, the cure is to install a colder plug. However there are many other conditions which have a bearing on making spark plugs display these symptoms.

TIMING AFFECTS PLUGS

For every 2° the ignition timing is advanced, the spark plug temperature increases 2°. Yet, power output does not increase proportionately. For example, at 12° timing over-advance, less than 2% power increase results. BUT, slightly over a 12° increase of spark plug temperature is brought about by the same amount of over-advance. Consequently, it follows that over-advancing ignition timing does little less than overheat spark plugs. This fact was also vividly illustrated at Champion's demonstration. Be sure that overheated spark plugs are actually caused by plugs of too high a heat range, and not by improper timing before replacing them with colder plugs.

DETONATION

Through a system of dual carburetors which enables the demonstrator to quickly change from low octane fuel to high octane fuel and back

(Continued on following page)

Seeing is Believing . . .

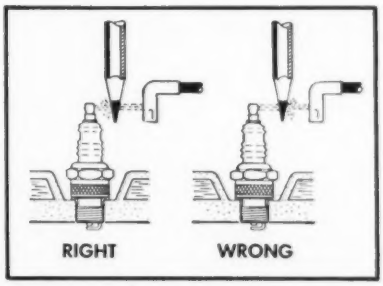
(Continued from page 35)

again, Champion engineers using the single cylinder demonstration engines can illustrate the harmful effects of detonation on both engine power and combustion chamber temperatures.

Using the low octane carburetor Mr. Dale showed his IGO audience how detonation can cause temperatures to rapidly increase several hundred degrees. In fact, high enough to approach the pre-ignition range. Allowing an engine to detonate cannot only weaken mechanical components, but seriously reduce power output. On today's well insulated water-cooled engines, it's possible for the engine to detonate without being audible to the operator. For this reason, it's always best to set ignition timing with a timing light, not by the "power" method of advancing the timing until a ping is heard under load.

CROSSFIRE

By running the demonstration engine with no direct wire connection to the spark plug, Mr. Dale emphatically demonstrated engine "crossfire" or induced leakage of current between conductive wires. To get his point across, he used a long high tension spark plug cable, one end of which was plugged into the coil tower, the other end connected to nothing. Then, he used another similar cable which had one end connected to the spark plug terminal. Placing these heavily insulated cables alongside each other allowed sufficient crossfire to easily run the engine. Even when the wires were several inches apart, enough induced leakage existed to keep the engine running!



Testing coil polarity with a lead pencil. If the spark flares and feathers out on the side of the lead nearest spark plug, coil polarity is correct.

Rough idle, and misfire during acceleration are the main by-products of crossfire. The only known cure is to separate the ignition cables that fire consecutively. For best performance on all high compression engines,

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see that the spark plug cables are as widely separated as possible. Never bunch the cables together and hold them with friction tape. And never route the cables through a metal conduit.

COIL POLARITY

Reverse polarity at the coil may require as much as 35 to 40% more voltage to fire the spark plugs as will be required of a coil connected in the correct polarity. Incorrect coil polarity is the real reason for a great deal of the claimed spark plug failure.

It is estimated that probably 10% of all passenger cars in use today are operating with reverse coil polarity. Among trucks, tractors, and industrial engines, this percentage can go as high as 20 to 25.

Coil polarity can be determined by use of suitable testing equipment. Many pieces of such testing equipment are available which can indicate coil polarity in a matter of a few seconds. However, in the event such equipment is not available, an ordinary wooden pencil can be used. To do this, remove the cable from any spark plug on the engine. Run the engine while holding the cable terminal about ¼" away from the spark plug terminal. Into the ¼" gap insert the pencil point, and watch the way the spark behaves as it travels through the pencil lead. If the spark flares or feathers and has a slight orange tinge on the side of the pencil lead that is nearest the spark plug, the coil polarity is correct. If the flare is on the other side—the cable side of the pencil lead—the polarity is incorrect. This testing technique can be mastered in a minute, and will serve as a reliable way to quickly check polarity.

At the completion of the demonstration, a short question and answer period followed, which soon revealed that the IGO men had a firm grasp of the ails and cures of automotive spark plugs. They also appreciated the fact that all so-called spark plug trouble is not caused by the plugs themselves. Learning to analyze the used plugs of a customer's engine, and, if necesary, finding out how to make intelligent recommendations for a change of heat range, plus understanding the basic function of the factors which influence spark plug operation, added up to an evening well spent for those in attendance.

Arrangements for a Champion demonstration before any group interested in automotive repair and maintenance, can be made by contacting the Public Relations Dept., Champion Spark Plug Co., Toledo 1, Ohio.

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Aluminum engine still faces development problems

• TWO ENGINEERS recently said they are "optimistic" about future aluminum automobile engines, although major problems still must be resolved in their development.

In a Society of Automotive Engineers' summer meeting, Darl F. Caris of General Motors Engineering Staff and Dr. Robert F. Thomson of the GM Research Staff reported on laboratory and road tests with three experimental V-8 aluminum engines.

"We believe we are aware of the major problems still to be resolved and are continuing research to develop aluminum power plants to provide the public with the best, most economical and type of power plant they want in their automobiles of the future," they said.

Aluminum for engine blocks has received considerable engineering attention because of its low specific gravity and lighter car weight possibilities.

Outside of the (car) body and frame, the largest single component part is the cylinder block. Present cast iron blocks and heads weigh between 200 and 300 lb. The possibility of removing significant weight from the power plant has properly focused attention on the cylinder block. Weight of an aluminum engine block and head is less than half the weight of cast iron components, resulting in an overall 30 percent reduction in engine weight, it is estimated.

The GM engineers explained the significance of this is cumulative "because as the engine becomes lighter, the supporting structure is lightened, and as this happens, smaller engines may be used to give the same performance (as today's cast iron) engines."

While aluminum automobile engines are not new, the speakers said they have been made either with a ferrous liner or a coating, such as chromium plate, for bore material. Both of these procedures are expensive and impose processing difficulties. The probable future use of aluminum in cylinder blocks depends largely on minimizing these two problems. "Obviously, the simplest solution would be a wear-resistant aluminum alloy which could be cast in a manner similar to that used in current cast iron production," Dr. Thomson said.

He stated also that many laboratory bench tests have been made to evaluate both coated and uncoated bore materials. Among the more promising are: Chromium plate, iron plate, electroless nickel plate, oxide type coatings, sprayed steel, sprayed molybdenum, sprayed aluminum and uncoated cast aluminum alloy, some of which are new alloys developed by GM.

Subsequent dynamometer and road tests have confirmed that a number of these materials are satisfactory from the wear standpoint, although it was emphasized that wear is not the sole criterion for judging satisfactory materials.

Low Brake Pedal Due to Missing Baffle Plate

In the event 1957 Ford owners complain that their brake pedal keeps getting low soon after an adjustment, the Ford service department suggests the following:

After adjusting the brakes and checking the fluid, take a look at the master cylinder filler cap and see if it has a baffle plate on the inside. If it does not have a baffle, it should be replaced with a filler plug that does. The baffle on the new cap keeps the fluid from being pumped out the breather holes in the cap.

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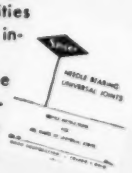

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Say You Saw It In
Automotive Service Digest

Universal joint service

With the adoption of the three-joint propeller shaft assembly and present trend towards more universals, the independent repair shop should get its house in order to adequately handle this important and profitable service.

By BEN IKERT
Editor

• THE CONSTRUCTION of needle bearing universal joints is simple and their removal from the motor vehicle is relatively easy. The joints also are readily disassembled and re-assembled—usually without the use of special tools. Practically the same removal operations apply to all makes, differing only in minor details.

Double flange yoke type joints are removed as a complete assembly by taking out the companion flange bolts, allowing the assembly to slip out from between the companion flanges. The latter remain on the transmission and axle (Fig. 1). Remove double end yoke types by taking out the cap screws, lock plates and bearings. The bearings in the lugs of the end yokes are taken out and the propeller shaft removed with the remaining journal crosses and bearings as a unit. The end yokes remain on the motor vehicle (Fig. 2).

Remove the U-bolts, nuts and lock washers from the end yokes. Then, slide the sleeve yoke towards the shaft to free the bearings from their seats between the shoulders in the end yokes. Take care not to drop the bearings from the trunnion ends of the journal cross at both ends of the propeller shaft. The end yokes remain on the motor vehicle (Figs. 3 and 4).

Universals may be flange-yoke construction on one end and end-yoke on the opposite end, with either or both ends constructed in the bearing-cap, snap ring, or U-bolt design (Fig. 5). Operations for removal from the motor vehicle are the same as given in preceding paragraphs for double-flange and double-end yoke types.

In the disassembly of snap-ring type Spicer joints, operations are as fol-

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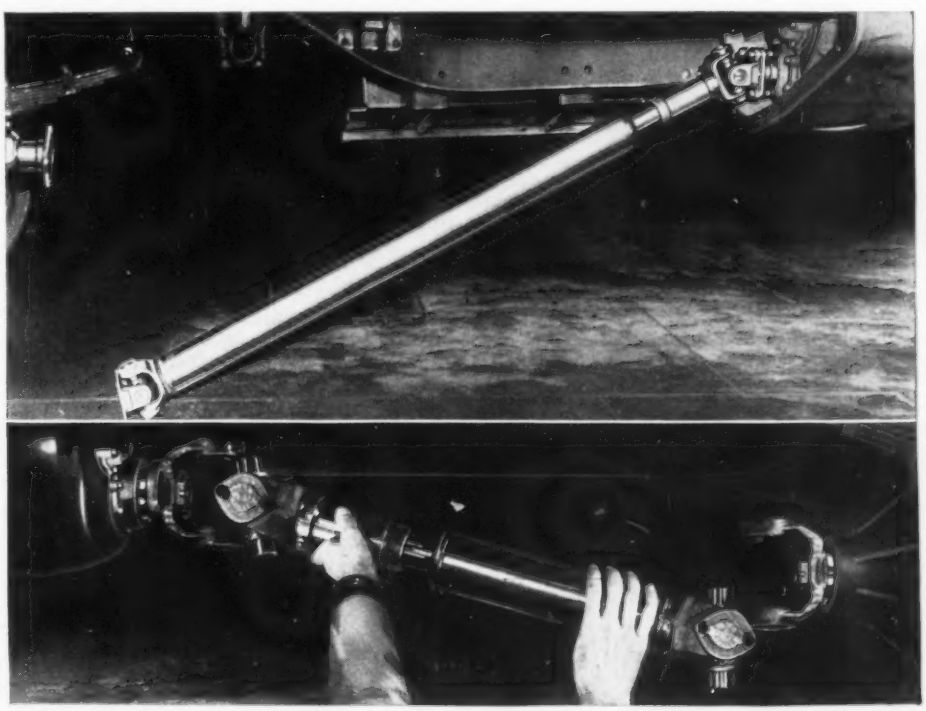


Fig. 1. Removing propeller shaft equipped with double flange yoke universals.

Fig. 2. The end yokes of the universal joints remain on the motor vehicle.

Fig. 3. In joint removal, care must be taken not to drop the two bearings of the cross.

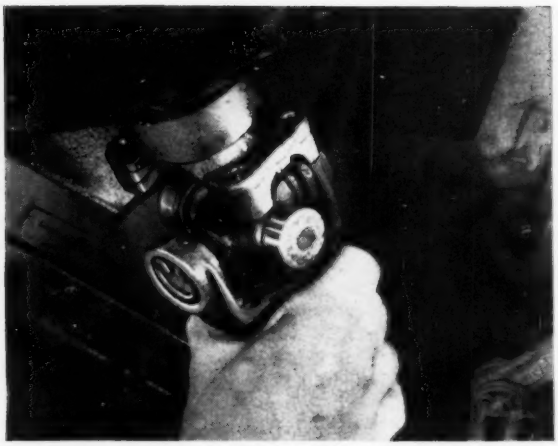


Fig. 4. Partially removed propeller shaft. End yoke remains in place.

U-Joints . . . CONTINUED

lows: Clamp the assembly lightly in a vise equipped with soft jaws. Using a small drift, tap the end of the needle bearing to loosen the snap ring. Move the bearing only enough to break the bearing away from the snap ring. Then, with round nose pliers remove the snap ring from the slip yoke or slip tube. Turn the joint over and repeat the operations.

Tap the bearing until the opposite bearing is free, using a soft round brass drift with a flat face and about 1/32″ smaller than the diameter of the hole in the yoke. This prevents bearing damage. The bearings also can be removed with the type of tool shown in Fig. 6. This tool simplifies the work of disassembly and reassembly of joints, also speeding up lubrication work and bearing replacement.

Turn the joint over and tap on the exposed end of the journal or cross shaft to remove the other bearing. Or, use the tool in Fig. 6. Then, remove the journal cross from the yoke, tip the journal and lift out the yoke.

REASSEMBLING JOINTS

To reassemble the snap ring construction, the procedure for disassembling is reversed. On joints without a lubrication fitting, repack the four reservoirs in the journal with a semi-fluid lubricant. With the roller in the bearing, fill the bearing about one-third full. Also lubricate the sliding spline shaft with a semi-fluid lubricant.

JOURNAL AND BEARING KIT

Field experience proves that it is not advisable to use a new journal with old bearings or vice versa. Backlash, endwise movement of the journal, or vibration of the joint assembly indicate worn joint parts and the best procedure is to install a new journal and bearing repair kit. The use of the kit insures having all of the correct individual parts when needed and also saves shop time.

Fig. 5. Combination flange yoke and end yoke type shaft.

Some motor vehicles are equipped with universal joints which have no provision for lubrication. A repair kit having a lubrication fitting generally can be installed for these. It then is possible to relubricate the joint periodically, assuring life of the joints and avoiding possible breakage of the journal cross caused by galling or seizing from lack of lubrication. But, don't over-lubricate.

CORK GASKET OR RUBBER SEAL TYPE

The cork seal gasket or rubber seal type of joint, shown disassembled in Fig. 7, is used on large trucks. To remove the bearings bend down the locking lugs of the lockstrap with a screwdriver and remove the two cap screws and lockstrap from each side of the joint yoke. If the bearing and cap are integral (Fig. 7), tap the bearing cap lightly clockwise and then counterclockwise, with a screwdriver. First pry under one end of the bearing cap and then the other until the bearing comes out of the yoke. Then, turn the joint over and remove the opposite bearing in the same way.

If the bearing cap and bearing are separate the cap will come off with a light tap (Fig. 8). The bearings can be removed by first tapping with a soft round drift on the exposed face of one bearing until the opposite bearing comes out. Next, turn the joint over and tap the exposed end of the journal cross until the opposite bearing is free. The journal cross can be

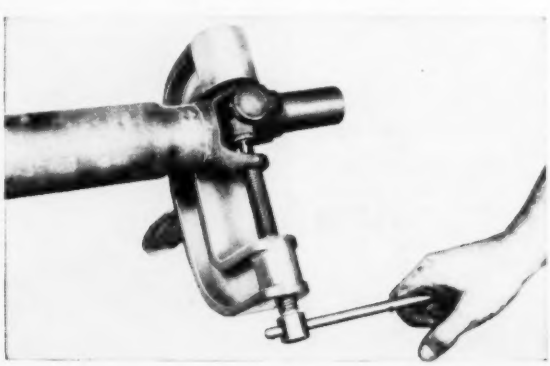


Fig. 6. Tool which simplifies disassembly and assembly of U-joints.

removed from the yoke by tilting the yoke slightly and lifting out the cross.

If inspection shows a new kit is not necessary, be sure that four new seals are installed between the journal retainers. With the Zerk fitting on the journal cross facing toward the tube end of the joint, insert one trunnion of the journal cross into the bearing hole in the yoke lug from the inside between the lugs and tilt until the trunnion will enter the hole in the opposite yoke lugs (Fig. 9).

Insert the bearing from outside of the yoke (Fig. 10). Press it into place with an arbor press or tap with a soft round drift so as not to mar any surfaces. Make sure that the key on the bearing cap fits into its keyway on the back of the needle bearing (Fig. 8). This is very important.

Assemble and bend the lugs of the lock strap up against the flat of the cap screw. Should the joint appear to be binding, tap the lugs lightly to relieve any pressure of the bearing on the end of the joint.

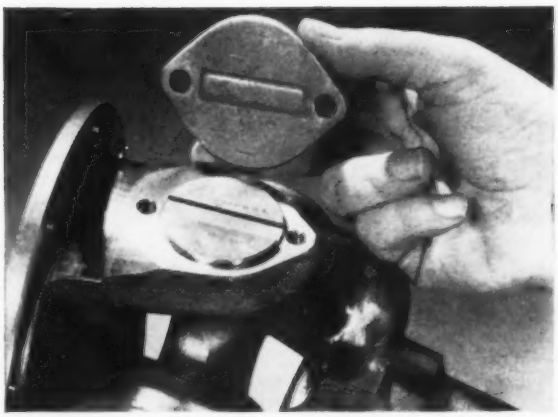


Fig. 8. If bearing cap and bearing are separate, cap comes off with a slight tap.

Fig. 9. Assembly is tilted until trunnion enters hole in opposite yoke lugs.

REMOVAL OF SLIP JOINT

The dust cap is unscrewed from the sleeve yoke and the joint is slid off

Fig. 7. Cork gasket or rubber seal-type joint.

from the spline shaft of the assembly (Fig. 11). In assembling the slip joint on the shaft, lubricate the splines thoroughly with 140 SAE oil and assemble the slip joint on the splined shaft.

When installing the propeller shaft make sure that the arrows on the shaft and slip joint are in line (Fig. 12), since the sleeve yoke lugs must be in the same plane as the stub ball yoke lugs to prevent excessive vibration in vehicle operation.

Next, place the propeller shaft assembly on a pair of V-blocks and check it for run-out. Run-out on the tube should not be more than .020", indicator reading. On the neck of the slip-stub shaft, run-out should not exceed .005" indicator reading. Mark the high and low points on the shaft with chalk and straighten the shaft, if necessary. The assembly should always be installed in the vehicle with the slip-joint nearest the source of power.

MECHANICS UNIVERSAL JOINTS

Mechanics universal joints for passenger car, truck and bus applications are of the needle bearing type. The crosses are of the non-lubricated type in some applications and lubricated types in others. Basic design of these joints is similar in that each includes a cross and four bearings. However, there are several methods of retaining the bearings in the yokes. Consequently the repair kit may consist of either wing or round bearings, or a combination of both. These are shown in Figs. 13, 14 and 15.

Wing bearings (Fig. 13) are retained in the joint yokes with cap screws, while round bearings (Fig. 14) are secured in the yokes with capscrews.

On Ford, Mercury, Oldsmobile and Pontiac cars, and some light trucks, four round bearings (Fig. 14) are used at the front or transmission end while two wing and two round bearings (Fig. 15) are used at the rear.

MECHANICS JOINT DISASSEMBLY

Turn down the ears of the lock plate and remove the two cap screws holding each main bearing to the lock of the joint yokes. Next, push the

(Continued on following page)

Fig. 10. Inserting bearing from outside of yoke. It is pressed or tapped into place.

shaft assembly towards the front to slightly telescope it and tap the wing bearings to free the bearing drive lugs from their keyway seats. The complete assembly can be easily removed from the motor vehicle.

Clamp the assembly lightly in a vise and remove the other bearings and crosses. Next, install a new repair kit, if necessary, by attaching the cross and two wing bearings first to the slip yoke and then to the shaft yoke.

This is done by inserting one of the wing bearings in the keyway in the yoke with the male curved pilot of the bearing resting on the female pilot of the yoke. The cork washers must be compressed somewhat before it is possible to assemble the opposite bearing. This is done by striking the corner of the bearing at an angle with a soft hammer to force the bearing down and into the seat at the same time.

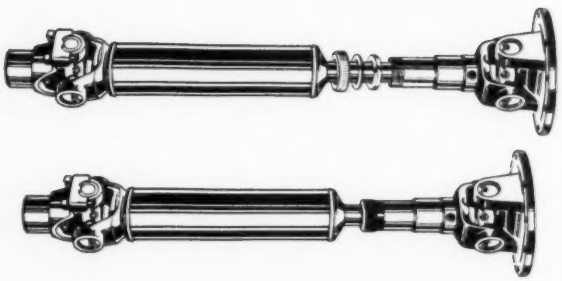


Fig. 11. With dust cap removed, joint is slid from splines.

If the slip yoke was removed from the spline shaft be sure it has been reassembled with the arrows in line. The assembly can now be installed in the motor vehicle being attached to the transmission yoke and the axle yoke. The same procedure is followed as previously mentioned. Obviously, the spline and both crosses must be lubricated.

After removing the cap screws holding the wing bearings to the axle slip yoke to be removed from the cross. Then, place the trunnions of the cross between the vise jaws and proceed the same way as when removing the first yoke. Remove the cross and two round bearings from the shaft yoke, following the same sequence as before.

To assemble the cross and round bearings in the two shaft yokes and front slip yoke, rest one of the yoke forks on a flat piece of iron leaving

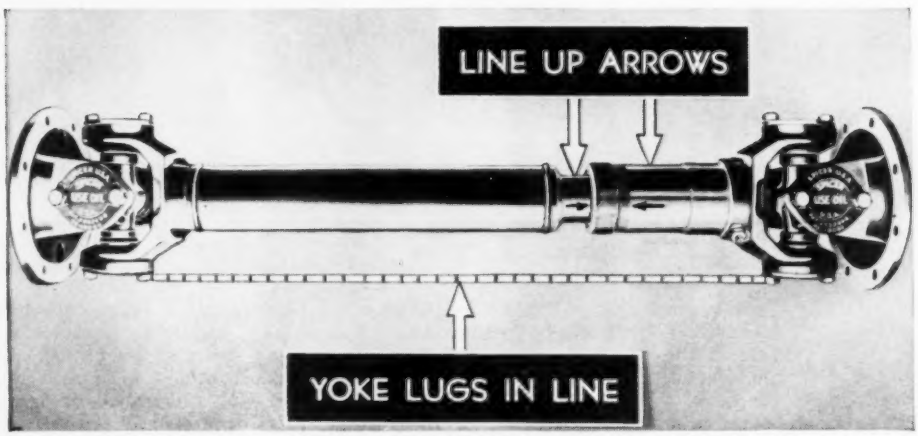


Fig. 12. When installing propeller shaft, arrow marks and lugs must line up.

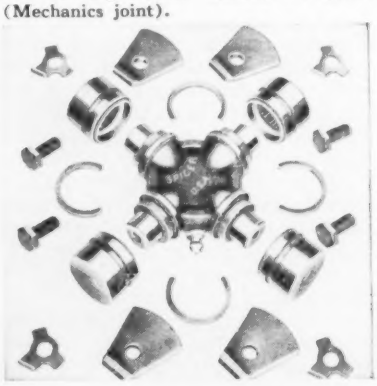
Attempt should not be made to install the cap screws until both bearings are seated on the yoke surface. Next insert the cap screw to the lock plate holes and screw them into the ring bearings. Tighten the cap screws and bend up one of the lock plate ears against the head of each screw.

Fig. 13. Type C or CL kit assembly for Mechanics joints, using cap screws.

yokes and pulling out the entire assembly to the rear as previously mentioned with the wing bearing type, clamp the assembly in a vise. Next remove the cap screw and end plate or snap ring from the four round bearings of the front joint and the two round bearings on the rear joint.

With the arms of one of the yokes suspended vertically in the vise and striking the suspended yoke, the latter will be driven down until it comes into contact with the cross. This allows the bearing to protrude. Clamp the protruding end of this bearing in the end of the vise so the axis of the clamped bearing is in the horizontal position. The bearing can now be completely removed by driving against the yoke with a soft hammer. After one of the bearings has been removed, turn over the complete assembly and follow the same operation to remove the opposite bearing. This allows the the other fork member freely suspended below. Then, drive one of the bearings in so the open end comes flush with the inside of the fork mem-

Fig. 14. Type R or RL kit assembly for securing round bearing in yokes (Mechanics joint).



ber. Insert the cross through the opposite hole without the bearing swinging it into place and down into the partially assembled bearing. Turn the assembly over, resting the partially assembled bearing on the flat metal surface and drive in the other bearing.

By thus continuing to tap the bearings they will both find their seat against the seat of the trunnion of the cross and will be approximately flush with the outside of the yoke. After doing this there may be some off-center condition between the cross and yoke. However, this is an advantage since it permits driving in the snap ring on the side with the most clearance

Fig. 15. Kit assembly CR or CRL (2 wing and 2 round bearings) for Mechanics joints.

After the first snap ring is in place, turn over the assembly so the assembled snap ring is at the bottom. Resting the yoke on the flat iron surface, strike the bearing on top. This drives the upper bearing down which carries the lower bearing with it. Do this until the snap ring rests firmly against the milled surface of the yoke fork. Then, put in the opposite snap ring. The operation is identical when assembling the slip yoke.

Lubricate both crosses and install the complete assembly in the motor vehicle by sliding the slip yoke on the transmission shaft and bolting the two rear wing bearings to the axle yoke. Tightening the cap screws and turning up the ears of the lockplate against the head of the tap screws completes the job.

Improper Use of Twin-Post Lift Can Damage Air Ride Lines

In a recent service bulletin, Chevrolet advises the use of extreme care when raising an air ride equipped car on a twin-post hoist—the car must be centered over the rear hoist so as to prevent possible damage to air ride lines entering the left hand reservoir. This is said to be especially critical if the air has been exhausted from the system.

Color Research Findings Used in Fleet Paint Plans

Special counseling on high visibility color combinations for mobile equipment on the highway will be offered the truck and bus transportation industries on the basis of studies made by Ditzler Color Division of Pittsburgh Plate Glass Co.

Announcing some of the results of its Color Dynamics research, the company said it will offer a safety color service built around high visibility combinations. Emphasis has been given the factors of apparent size and apparent distance in preparing a basic series, which offers a selection of 43 colors, an extensive range of two-tone arrangements, and a guide for meeting durability requirements.

Check Fuel Tank Vent

Accumulated air in a fuel tank is vented out through a separate chamber in the filler tube, and Plymouth points out in a recent service bulletin that it is very important that the vent chamber opening at the fill end of the filler tube in their '58 models point straight up. If the vent opening is downward, accumulated air will allow only 10 to 14 gallons of gasoline to enter the tank.

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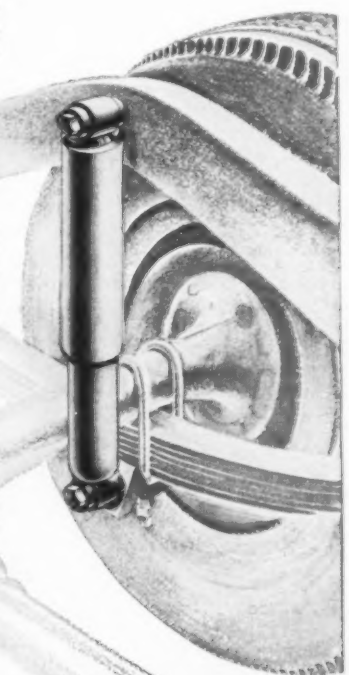

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By ED PACKER
Member, S.A.E.

Servicing air conditioners

With the increasing number of cars being air-conditioned for passenger comfort, a profitable business of installing, testing and servicing the units awaits the shopman who understands how and what makes them work.

Part II—Basic Shop Requirements

• DON'T LOOK with awe upon the service man who can work on an air conditioning system. He's just another good man with the right tools and the necessary know-how for handling specialized work.

Did you ever install a fan belt? Or have you used an engine compression gauge or a vacuum gauge? If you have, and have also installed or removed a generator and replaced a few brake lines, you've done work practically identical with the jobs performed in servicing an automobile air conditioner. It's just that simple—simple that is, for a good all-around service man.

But don't laugh off the importance of good thorough procedures. For example, you won't rate very high with the customers whose compressor belts fail at low mileage, unless when replacing the belt, you find *why* the last one failed. For one motorist, a slight misalignment of the compressor bracket was putting many expensive belts in the scrap pile . . . but an alert serviceman spotted the trouble.

Filing the bolt holes of the compressor bracket (see Fig. 1) cured it. Note how (Fig. 2), the properly adjusted belt perfectly parallels the large steel square that's used to check alignment of the compressor pulley.

On the basis of the satisfactory job, that motorist practically put on a one-man advertising campaign for the shop that had cured his trouble.

To do any and all kinds of air conditioner service work requires just enough space in your shop for one car plus a general bench nearby. In Fig. 3, the shopman is using such a bench while double flaring a tube so that the connection will prove gas tight under the high pressure of a Freon-12 charge.

Fig. 1. Filing the bolt holes of the compressor bracket cured a customer's complaint of belt failures due to misalignment.

Fig. 2. A properly adjusted belt perfectly parallels the large steel square used to check alignment of the compressor pulley.

One of the most common repair jobs that any skilled mechanic is called on to make is to correct leaks in an air conditioning system. These leaks don't have to occur. But experience indicates that "bargain installations" do not always measure up to the high standards that *should* prevail in an automotive air conditioner. With expansion and contraction added to highway vibration, only the best of connections is good enough.

In the schematic layout of a modern air conditioning system—presented in Part I of this series—it was noted that the system required both pressure *and* vacuum. We will not review the operating fundamentals given previously, but it might be worth while now to check back to that illustration. Two gauges with connecting valves are used for trouble-shooting and servicing any air conditioning system. One of these is the low pressure, or vacuum gauge; while the other is the high pressure gauge.

Anything from leaky connections to a slipping compressor belt can upset the required pressures. Then the job is one of belt replacement or adjustment; or of finding and correcting the leak and replacing the lost refrigerant.

Fig. 3. Double flaring a copper tube to provide a gas-tight connection.

Too often the "correction" of the leak is not thorough. An inexperienced mechanic may pull up the fitting with ordinary open-end wrenches (box wrenches should always be used). And some mechanics will replenish the refrigerant without making any check for the leak.

Leak testing is done with a torch, such as we see in Fig. 5, in which the tiny flame changes color conspicuously when a "sampling tube" is brought near a leak. Some persons check for leaks with a bubble-making fluid such as kids often buy in the dime store. But the torch is standard equipment with any serious air conditioning service specialist.

In Fig. 4, the big piece of equipment on the front fender is a vacuum pump. It's good to have, but its purchase can be postponed until your volume of air conditioner service justifies it. Meantime, the air conditioner compressor on the car can be used for evacuating air and moisture from the system.

EQUIPMENT REQUIREMENTS ARE SLIGHT

From the foregoing it can be seen that there is not much tool equipment to buy to qualify for air conditioning service. It is assumed that any good service shop already has tubing wrenches, torque wrench handles, tubing flaring tools, together with a generous assortment of sockets, open end wrenches and such. It will have a good substantial bench and vise for customary work needs.

Fig. 4. Trouble-shooting the system with the aid of a set of high and low pressure gauges connected to the compressor and a vacuum pump (sitting on fender).

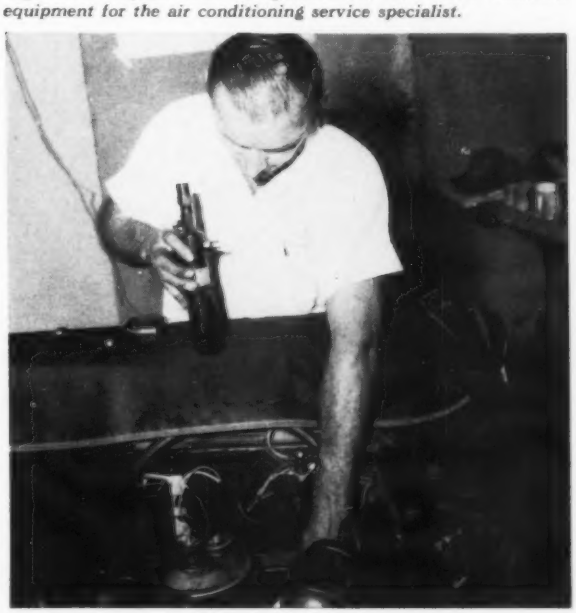
Specialized equipment will include the gauge shown in use in Fig. 4. How it is connected to the compressor to make both a high pressure and a low pressure test when adding to the refrigerant, is shown schematically in Fig. 6. By connecting the center line of the gauge and valve assembly to a Freon-12 supply, they are hooked into the system for adding refrigerant, using the compressor as a vacuum pump. This gauge assembly is *always* used when handling a refrigerant such as Freon-12.

HANDLING THE REFRIGERANT

Freon-12 is a transparent and colorless refrigerant in both the gaseous and liquid state. It has a boiling point of 21.7°F below zero and, therefore, at all normal tem-

(Continued on following page)

Fig. 5. A Propane fired refrigerant leak detector is standard equipment for the air conditioning service specialist.



peratures and pressures it will be a vapor. The vapor is heavier than air and is noninflammable, nonexplosive, nonpoisonous (except when in contact with an open flame) and noncorrosive (except when in contact with water). The following precautions in handling Freon-12 should be observed at all times.

All refrigerant drums—which look like small welding gas cylinders—are shipped with a heavy metal screw cap. Its purpose is to protect the valve and safety plug from damage. Good practice is to replace the cap after each use of the drum.

If it is ever necessary to transport or carry a drum or can of refrigerant in a car, keep it in the luggage compartment. Refrigerant should not be exposed to the radiant heat from the sun, since the resulting increase in pressure may cause the safety plug to release or the container to burst.

KEEP AWAY FROM HEAT

Drums or disposable cans never should be subjected to high temperature when refrigerant is being added to the system. Generally, heating the container is necessary, to raise the pressure higher than that in the system, during the operation. It is unwise to place the drum on a stove or radiator, or to use a blow torch, in preparing for the charging operation—A serious accident can result. Don't depend on the safety plug—many drums have burst when it failed. Remember, pressure can be a powerful force. A bucket of warm water, not over 125°F, or warm wet rags around the Freon-12 container is all the heat that is required.

Do not weld or steam clean on or near the system. These operations can produce a dangerous pressure build-up in the system.

When filling a small drum from a large one, never fill completely . . . space should always be allowed above the liquid for expansion. If the drum were completely full and the temperature increased, hydraulic pressure, with its tremendous force, would result.

Fig. 7. When installing a magnetic clutch on compressor to replace the original solid pulley, it is not necessary for the compressor to be removed from the engine.

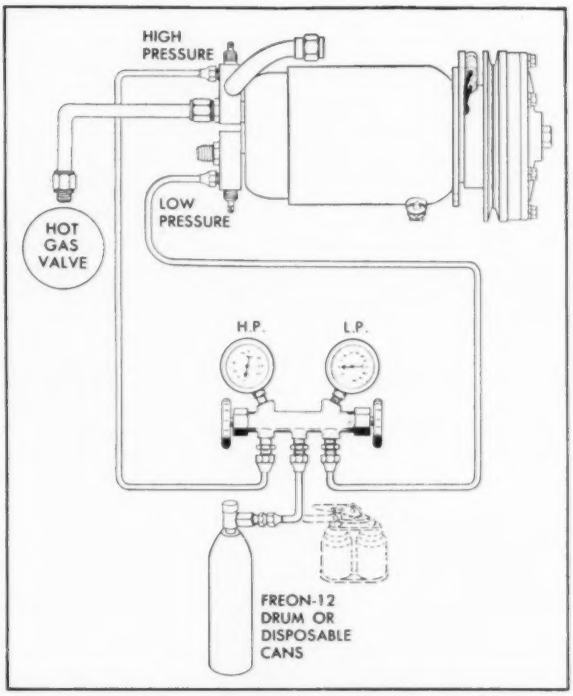


Fig. 6. How high and low pressure gauges are connected to compressor and to Freon-12 supply.

Discharging large quantities of Freon-12 into a room is usually safe, as the vapor will produce no ill effects. However, this should not be done if the area contains a flame-producing device such as a gas heater. While Freon-12 normally is nonpoisonous, heavy concentrations in contact with a live flame will produce a toxic gas. That gas will also attack all bright metal surfaces.

EMERGENCY TREATMENT

Protection of the eyes is of vital importance! When working around a refrigerating system, there is the possibility of an accident that causes refrigerant to hit the face. If the eyes are protected with goggles or glasses, no serious damage can result. *Just remember—any Freon-12 liquid that you can touch or that touches you is at least 21.7°F below zero.* The eyeballs can't take much of this temperature. If Freon-12 liquid *should* strike the eyeballs, here is what to do:

1. Keep calm.
2. Do not rub the eyes! Splash the affected area with quantities of cold water to get the temperature gradually above the freezing point. The use of mineral, cod liver, or an antiseptic oil is important in providing a protective film to reduce the possibility of infection.
3. As soon as possible, consult an eye specialist for immediate and future treatment.

TRACING REFRIGERANT LOSS

The next specialized piece of equipment is the leak detector (seen in Fig. 5), used in checking-out the cause of refrigerant loss in a system. Incidentally, Freon-12 is generally used by the larger shops from 25 pound drums; and in shops that have a limited volume of business, from 15 ounce disposable cans. The 25-pound drums are hooked up very much like a cylinder of welding gas,

while special small valves are available for the disposable cans of Freon-12. For jobs larger than a single can will accommodate, there is a multiple holder that handles three cans in parallel (Fig. 6).

Now to check-out where the refrigerant made its getaway, the leak detector is used. Note that (in Fig. 5) the lower part of the detector held in the mechanic's hand is a propane gas cylinder. On this is mounted a valve assembly, which carries a burner head and small chimney.

From the burner head, a sampling tube extends (not shown in cut). This tube is moved from one fitting to another—in fact, to all parts of the air conditioner system —in search of leaks.

Freon gas drawn into the sampling tube attached to the torch, will cause the torch flame to *change color* in proportion to the size of the leak.

Common sense has to be the determining factor in performing leak tests. Follow the system all the way through, including the compressor, the valves, connectors, tubing and such.

WATCH FOR FLAME COLOR CHANGES

The best leak detector flame stands about 3/8" up in the chimney. The flame should be blue. As the sampling tube is moved along the air conditioning system, watch the flame for color changes. The chimney contains a reaction plate that is normally heated to a cherry red. Where the blue flame passes through the reaction plate, this flame will change to *yellow* if the sampling hose draws in even the slightest trace of Freon-12. Larger leaks will be indicated by a change to a vivid purplish blue color. As the sampling hose passes the leak, the flame will clear to an almost colorless pale blue.

If the flame *remains* yellow when the sampler tube is withdrawn, insufficient air is being taken in, or the reaction plate is dirty. Generally, blowing compressed air through the sampling hose and back through the leak detector will clear dirt or foreign matter. Probably the best way to clean the reaction plate is to let the flame burn for several minutes. As a rule this will consume any dirt that was on the plate. If this doesn't do the trick, then remove the plate, which is attached to the chimney with a single screw, and scrape the surface gently.

It is a good idea when planning to enter air conditioning servicing to talk with your jobber and/or tool supply man regarding your needs. If you propose to go in not only for servicing, but for installing air conditioners as well, you should have both a 1/4" and a 1/2" electric drill (which you probably have anyhow) together with hole-cutting attachments. Fairly large rubber hose must lead down from the cooling coils in the car body to carry moisture away. And both large and small holes will be needed in the dash or firewall to complete the other connections.

ACCURATE SCALE A MUST

For dispensing controlled amounts of refrigerant from the 25 lb. drums or tanks, you will need an accurate platform scale. With it, you can measure the weight of the drum as you begin to charge the system, and thus keep track of how much refrigerant is required.

Frequently motorists economize in their original car air conditioning purchase by omitting the magnetic clutch. This saves them some fifty or sixty dollars originally. Then they often go out and spend this money by having a shop install a magnetic clutch on the compressor in place of the original solid pulley (Fig. 7). Occasionally this job requires a puller. But since well-equipped shops generally have universal pullers, this can hardly be classified as specialized air conditioner equipment.

ADVANTAGES OF AUTOMATIC CLUTCH

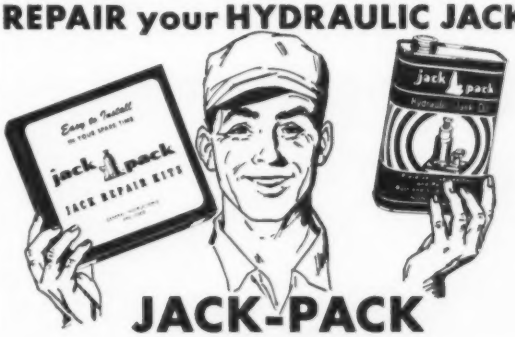
An automatic clutch that cuts off the compressor when the air conditioner is not needed has several advantages. In the first place it reduces the load on the engine and thereby saves gasoline. In the second, it cuts down wear and tear on the belt and compressor. Reducing the engine load results in the car being somewhat livelier. But perhaps the greatest advantage is that with the compressor at a full stop, the cooling coils do not cool the car excessively, making passengers uncomfortable; nor create condensation that drips on their feet.

While in the past some manufacturers of air conditioners argued against the magnetic clutch, the trend today is strongly in favor of a magnetic clutch which is operated either by a dash switch at will of the driver or automatically through a temperature controlled solenoid. In any event, the installation and servicing of magnetic clutches is important.

The details of the required procedures will be included in future articles. It is, however, self-evident that any good service man can become a specialist in air conditioners without much additional investment in tools or equipment; and that the required know-how is "easy to come by." The fact is that most specialized factory schools present a two-day course . . . in other words, that 16 hours of instruction is generally considered sufficient to qualify a competent service man for air conditioner work. While factory training covers one specific make, the fundamentals of all makes are so similar that the man trained to service one line will have little difficulty with the others.

(**Next Month**—servicing the air conditioning systems of G.M. cars)

Here's ALL YOU NEED to REPAIR your HYDRAULIC JACK!



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HYDRAULIC
JACK REPAIR KITS & JACK OIL

JACK-PACK repair kits contain easy-to-follow instructions and all the packings necessary to make your jack work like new. And, be sure to use JACK-PACK hydraulic jack oil. It's the only oil with complete instructions for filling and bleeding your jack on the can.

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ORDER FROM YOUR JOBBER!

Today's modern trend of body design makes it imperative that shop operators be able to give an accurate computation of parts and labor requirements, as well as come to a complete understanding with customers on the total cost of complete restoration of a damaged vehicle, if the shop is to profit from . . .

Body and frame service

By GUY F. WETZEL
Technical Editor

• BODY AND FRAME service classifications of automotive service work differ quite materially from mechanical classifications. In merchandising this service, the general principles applying to selling any kind of service must be observed, but, at the same time, the limitations and governing factors must be considered.

One of the most important factors is the requirement (by the insurance companies) that bids for repairing existing damage be obtained from three reputable shops.

Even if circumstances are such that the car owner has to pay the full cost of the repair job himself, he will want, in most cases, several bids for the purpose of comparison to judge the fairness of the prices. This puts it squarely up to the shop operator or the estimator. He must have the bid high enough so there will be profit for the shop, and, at the same time, low enough to meet competition and get sufficient business.

If we assume that each job, other than minor fender or door panel jobs, is figured by three shops, then each shop should average one out of three jobs on which estimates are made. Less than this proportion indicates that something is wrong with the estimating, or that costs should be reduced by improved equipment, and possibly improved methods. More than one out of three jobs shows that the estimates are low enough to get the business, but they should be checked carefully from the profit angle.

The way the customer is treated is an important factor when it comes to getting the order. To him his job is quite important, even though the shop may be only casually interested. From his buying habits he expects to be treated as though the shop desires to be of service to him. He appreciates an explanation of some of the various operations that have to be done, and differences in both results and cost between replacing and repairing; the facilities of the shop for doing first class work, and the time involved in getting the job done. This is important, since he does not want to be without his automobile for a longer period than necessary. It's good preliminary service selling.

Frequently bids on a job will be quite close, so if the customer is sold on having the work done in a certain

This wrecked '54 Cadillac is a good example of where extreme care must be used in estimating the cost of restoring the vehicle to original condition —mechanically, as well as appearance-wise.

Shop foreman greets customer and explains details of the job estimate to him . . . a selling effort which pays off very well.

shop, either he will pay the difference or if the bid is not too high, the favored shop can meet the competitive price. Naturally, if there is a big difference between prices, the insurance company will insist on the shop with the low bid getting the work. In such cases someone, either the very high or the very low bidder, has made a mistake.

REPAIR OR REPLACE?

On many parts, the decision has to be made whether to repair or replace. The prices of parts on late model cars are comparatively high; but, on the other hand, the cost to repair many of the complicated shapes, especially around head lamps on front fenders, also is high. In cases of damage to the front corner, it is frequently better to replace parts.

Where it is a 50-50 choice of repairing or replacing, the shop conditions should be the guide. In dealer shops where parts are on hand and the dealer's discount is satisfactory, it will probably be better to replace than repair. On the other hand, in the independent shops, where the parts have to be bought from a dealer or supply house, and the discounts are not so favorable, it is better to sell labor than parts.

The matter of aligning parts must also be considered. For example, if a car is damaged on the right or left front corner, and both the fender and hood are deformed, it is generally advisable to replace the fender. The new fender will then act as a guide in aligning the hood, which often can be satisfactorily straightened.

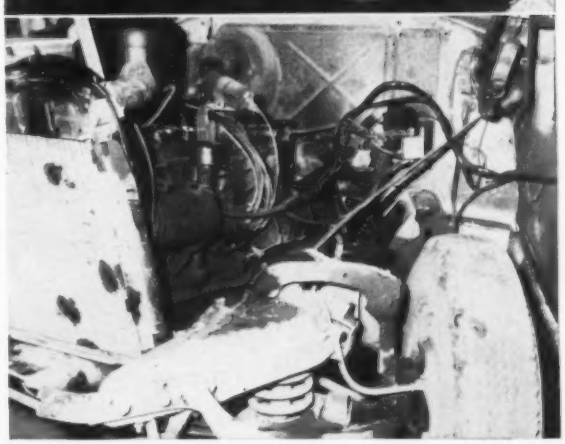
The general character of body work has changed considerably since the introduction of the integral rear fender and quarter panel around 1949. It has further changed in the last few years as the cars have begun to resemble rolling juke boxes, with all the fancy grilles and complicated bumpers, head lamps and trim at the front, and "Christmas-tree-type" rear lights and trim. A relatively light blow at any of the four corners of the car may require several hundred dollars' worth of parts in the way of new fender or quarter panel, lamps, bumper parts, grille parts, trim, etc., on the outside, plus braces, brackets, hangers, and panels in the inside.

All this means that there is a great deal more disassembly and reassembly and less metal work. The assembly work is largely priced according to flat rate manuals—with most of the figures being taken from the factory time allowances. In many cases the figures are based on assembly line time allowances, which are quite different from body repair shop conditions.

For example, the time allowed to replace the hood on 1957 and 1958 Mercury cars is 1.1 hrs. In this time the damaged hood has to be removed, and the new one installed and aligned. The new hoods come *without holes*, so that 38 holes have to be layed out and drilled as part of the job. The holes for the letters "M" and "Y" are covered by the hinges at the front of the

(Continued on following page)

1956 Plymouth that was struck on left front corner. This relatively simple appearing job ran over $400.



A new radiator support frame, inner fender panel, as well as a new fender were needed. Here we see the damaged parts removed, ready for the new ones.

On the frame machine the mechanic utilizes his hydraulic body jack to force the bent frame horn into position . . .

. . . and checks alignment by measuring from a hole in the center brace to each frame horn end with a steel tape measure.

Body Service . . . CONTINUED

hood which requires that these two letters be put in place *before* the hinges are attached to the new hood. This normally should be done after the hood is painted. The time actually required for this job is close to four hours, and the body man has to be on his toes during this period.

With short time allowances on jobs where most of the work is replacement, the men on the job, who work on commission, lose. If they are working on straight time, the shop loses out. In either case such a situation is bad.

In the old days, when bumpers were strictly for utility, two or four bolts would hold them in place and it was just a matter of five minutes to take off or put on a new bumper bar. But now, with the elaborate front bumper assemblies on many of the late models, it takes half an hour merely to assemble the parts of the bumper, plus more time to anchor all the parts in place. Between the time involved and the price of the parts it is easy to understand why collision work costs have soared, and why insurance companies have had to raise their rates year after year.

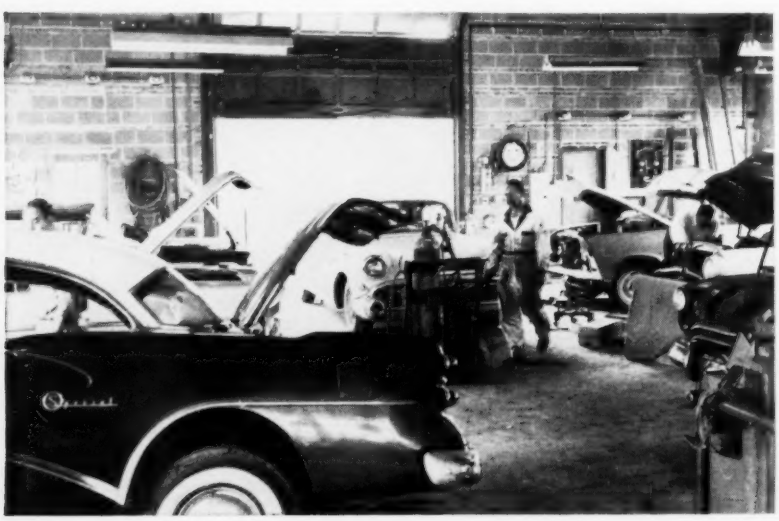
For those shops which have their own frame machine, additional sales ammunition is available which should be used in selling repair jobs. These jobs seldom run under a couple of hundred dollars and so are worth going after.

Few car owners have any idea of what is involved in a frame straightening job. Therefore, one of the most effective steps that can be taken, where frame work is involved, is to show the customer the frame department, with a job in process and explain how well you can take care of his work. Further show him a few of the gauges used in checking alignment, the specifications giving the frame dimensions, and tell him of the care put on each job to be sure the alignment is perfect. This makes a good impression on the prospect and will command respect for the shop's facilities and ability of the men.

HIGHLY VALUED INSTRUMENT

A man's automobile is his second biggest investment, if he is a home owner, and usually his biggest investment if he has not bought a home. Being a highly valued investment, he is much interested, when repairs are needed, in having a dependable and satisfactory job done on it. Even if prices apparently are far apart, there is frequently a good reason, such as variations in the parts to be put in, or work listed. If he wants your shop to do the work, he will make it as easy as possible for you to get it and help balance out discrepancies in different bids.

When it comes to making the estimate on the job, it is necessary to be very observant as well as to understand the construction of each of the



Body repair shops don't have to be dark and dingy, as evidenced by this clean, well-lighted shop of Lehigh Auto Construction Co.

cars that come into the shop. The items of trim, moldings, braces, inner panels, etc. all run up the price where they have to be replaced or straightened. Frame damage may not show up until the other damaged parts are removed, but must be accounted for in the bid, if it is needed. Radiators, fans, engine mounts and engine castings all must be considered. In cases where bids are far apart, it frequently happens that some significant items have been overlooked. In cases where it is possible to talk to the customers, and where they have been sold on your shop, comparing the work and parts covered in the estimate will get the job often enough to make the effort well worth while.

Here a mechanic assembles the bumper of a late-model Pontiac. Getting the parts together and bolting them to each other took over half an hour. This is typical of the added labor required by fancy bumpers and grilles.

A GOOD EXAMPLE

The Lehigh Auto Construction, Inc., in Niles, Ill., is a good example of expert service selling. The shop is in a new building, with plate glass windows in front, and with neon window signs identifying the shop. It is clean, orderly and well equipped. At one end a modern heavy-duty frame machine is installed in a pit so that the runway is level with the floor. An experienced frame expert is in charge of the frame work and every job that goes out is up to factory specs.

The shop foreman greets all prospects and explains their shop facilities and the quality of work done. The car owner is taken around the shop and the work is explained to him. After a careful inspection of the damaged car an estimate is made out and given to the customer. In cases where the decision as to who shall do the job is made by the insurance company, the price is largely the determining factor. In such cases, the normal percentage of work is obtained, showing that the estimating is skillfully done and in line. Where the customer makes the decision, the sales efforts put forth swing the balance to Lehigh frequently enough to pay out.

One of the recent Lehigh jobs involved a 1956 Plymouth. Damage at first glance did not appear too serious, but when all parts and labor were listed, the job amounted to over $400, as itemized elsewhere in this article.

On this job, the front fender was replaced because the damage was quite extensive and it was cheaper to replace than straighten. Also, in order to get correct alignment between fender and hood, it was advisable to have one of these parts new. With the new fender the alignment of the damaged hood was done readily. The left front frame horn was bent so the car was placed on the frame machine. This part of the job proved to be quickly and easily done which helped out the rest of the job on which there was a lot of new parts assembly.

REPAIR ESTIMATE FOR 1956 PLYMOUTH, 2-DOOR PLAZA

DESCRIPTION OF WORK	MATERIAL	LABOR	PAINTING & SUB-LET
Str. lft. front door & repl. molding	$ 3.50	$ 4.50	$ 8.00
Repl. lft. front fender, molding & inner ext.	44.85	13.00	12.00
Repl. lft. head lamp & door	15.30		
Str. lft. cowl, repl. front fender inner skirt		15.00	
Repl. lft. park lamp assembly	6.25		
Repl. radiator core support & fan blade	24.65	13.00	
Repl. lft. outer center & rt. outer grille bars	44.00	5.00	
Repl. front gravel deflector	11.95	3.00	6.00
Repl. front face bar (exch.) and 2 guards	11.50	5.00	21.00
Str. frame		26.00	
Str. bumper back bars, rt. side, repl. lft. side	6.95	4.50	
Str. and align hood, repl. lft. hinge & upper hood lock	7.85	35.00	12.00
Repl. hood molding center section	3.85		
Str. and align rt. front fender		10.00	12.00
Correct front wheel alignment		9.50	
Material			6.50
TOTALS....	$180.65	$143.50	$77.50

Less 10% on material plus 3% Ill. tax	$167.53
Labor	143.50
Painting & Sub-Let	77.50
Towing & advance chgs.	20.00
JOB TOTAL	$408.53

CHECK BACK ON ESTIMATES

An essential part of running a body shop is checking back on the estimates on which work has been done, to see how close the total price comes to a profitable figure. Where the men are working on commission, the job costs are fixed for labor, as the labor will be 50%, or whatever percentage is used, of the customer labor charge. Where the labor payment is on an hourly or weekly basis, labor costs must be checked either on each job or periodically, to be sure that the labor estimates and actual payments for labor are in line with each other.

Up-to-date parts lists will give accurate parts costs, so that charges for parts should be in line. The only precaution needed here is to be sure that all the needed parts are charged for. Also, be sure that the parts prices used are up to date. For example, the National Auto Parts and Labor Manual published by National Market Reports, Inc., is kept up to date and revisions are sent out to subscribers when parts prices are changed, which makes it easy to have the correct prices at hand at all times for estimating.

Body and frame service can be profitable if: (1) sound selling procedures are followed; (2) estimates of work to be done are accurate enough to get the expected proportion of jobs figured; (3) the estimates provide for a reasonable profit margin, and (4) costs are kept in line.

By STOKES TAX CONTROLS, INC.

Tax guide and business briefs

Are you planning to sell your business?

• SOME AUTOMOTIVE merchants feel that they do not have the youth or health to go through a rough business year and they are ready to quit. It would take volumes to explain the experiences in negotiating to sell or buy automotive businesses. Here are a few of the highlights.

Be careful of your negotiations with brokers. They expect to receive a substantial commission on the sale of a business. Suppose you tell a broker that you will sell at book value and give him a financial statement. The broker later produces a buyer but you tell him you have changed your mind and will not sell. Under these circumstances, you will probably owe the broker his full commission. If you use a broker, pick a live-wire with a good reputation. He can shop for you without a firm price. Blind advertisements in trade papers will be helpful but if your advertisement and the broker produce the same prospect, you may be in another commission debate. You will have problems in keeping your plans from your personnel.

START WITH AN APPRAISAL

Assuming that you find a good prospect, the most debate will concern the market value or rental value of the real estate. Find out the average rent which an operation of your size can stand. It will pay you to get a thorough appraisal of the fair market value of the real estate and its rental value. The appraisal should state the basis of the appraisal and consideration should be given to the suitability of the premises for other industries. This appraisal will be the foundation of your negotiations with the prospect. If you rent, you will want as long a lease as possible. Leases based on profits or sales volume develop accounting problems. At least, you should have a floor to your rent. Rent at a specified sum per month will probably be best for you. Make sure your attorney checks the lease thoroughly. Some lease forms would have the landlord pay for everything but the light bulbs.

If you rent from an unrelated party, examine your lease to determine whether it is transferable and whether you can be released from liability if it is transferred. Your landlord will want to hold you as guarantor if possible. This might be rough if your successor should have a poor operation.

If you are a new car dealer, you probably will not recover anything for goodwill. If you are engaged in another automotive line, the amount which you can obtain for goodwill depends on the facts. Obviously, a long established business with a good following is more likely to be paid for goodwill. You will decide whether your successor should use your name. If you do not want him to use your corporation name or your assumed business name, consult your attorney to find out how you can be protected. Sometimes, the successor can get the name with a minor variation. For instance, the successor to Blair Chevrolet Co. was Belair Chevrolet Co.

TAX PROBLEMS

The buyer probably will refuse to buy the stock of your corporation. If you have a large operating loss carryover for tax purposes, the buyer may buy the corporation and pay something extra for the benefit of the loss. If the buyer buys the corporation, he will want you to place an amount in escrow to protect him against undisclosed liabilities of the corporation. This is a reasonable request. If you have a large earned surplus, you can keep your corporation and operate it as a personal holding company and avoid capital gains tax on liquidation. However, you must have expert advice on this method if you are to avoid tax problems. If correctly handled, there should be no tax problems.

The buyer will probably refuse to buy accounts receivable. If he does not buy them, handle collections personally or hire a collection agency. Where the receivables are to be collected by the successor, the results are usually poor. Collections are likely to be applied first to the accounts of the successor. Action against debtors will be affected by the desire of the successor to keep customers.

The successor ought to be willing to pay for a favorable State Unemployment Insurance Credit even though he could probably obtain it without your consent if he takes over the business.

PARTS AND ACCESSORIES

Good quality parts which fit the current and three preceding years should be saleable at cost. The sale price of older parts is a matter of negotiation.

Fast moving accessories of the current and next preceding year should bring cost. The sale price of other accessories will have to be negotiated.

Any profit on the sale of parts and accessories will be taxed as ordinary income.

Used vehicles and service vehicles will probably bring wholesale used car prices. Profit on sale of vehicles used in the business and held for six months or more will be taxed as capital gain.

Profit from sale of real estate held for six months or more will be taxed as capital gain. If you subsequently liquidate your corporation, the same profit may be taxed again. Consult your tax advisor about liquidating your corporation if you will make a substantial profit on the sale of the real estate. This double tax can be avoided if you obtain competent advice in advance.

The selling price of your equipment will be affected by the other terms of the sale, especially the lease. Also a physical inventory of equipment will be necessary. In order to guess the possible sale price, you might assume that you could recover half the replacement cost. Another approximate formula might be to base the selling price on your original cost less half the book depreciation reserves. One

of the new car manufacturers which has bought out some dealerships is using the latter formula.

Profit from sale of equipment held more than six months will be taxed as a capital gain.

Don't pay over customer deposits and credit balances. Pay them to the successor individually upon proof of demand by the customers.

The buyer will ask credit for vacation pay for employees. It is best to pay vacation allowances direct to employees and let them arrange time off without pay with their new employer.

If equipment is sold at public auction, you can expect good prices for older general usage equipment and poor prices for such items as late model steel furniture, office machines, etc. You could have an estimate made by an equipment dealer and plan that you could do somewhat better at public auction.

SELLING PARTNERSHIP INTEREST

If the business is a partnership and you sell your interest in the partnership, your tax advisor should supervise the transaction. What is good for one partnership may spell trouble for another and it is difficult to set forth all the rules in space available. You will have to pay as ordinary income on your share of profits for the current year. Suppose you file personal tax returns on a calendar year basis and the partnership has a fiscal year ending January 31; calculate in advance the effect of including in your 1958 personal return the profit for twelve months ended January 31, 1958, and the profit or loss from February 1st to date of sale. The effect on your taxes may be good or bad.

Your partnership interest can be sold for whatever you can get. Your cost, generally known as "basis," will be the original purchase price of your partnership interest plus the share of the profits on which you have paid tax without withdrawal from the business plus your share of tax-exempt income not drawn from the partnership. The difference is your profit which is taxed as capital gain (Section 741 Internal Revenue Code); but don't forget Section 751 which taxes unrealized receivables and appreciated inventories as ordinary income.

If you sell your interest in a corporation, your profit will be taxed as a capital gain if you held the stock more than six months and if you sell all your stock. This is so even if your stock is redeemed by the corporation.

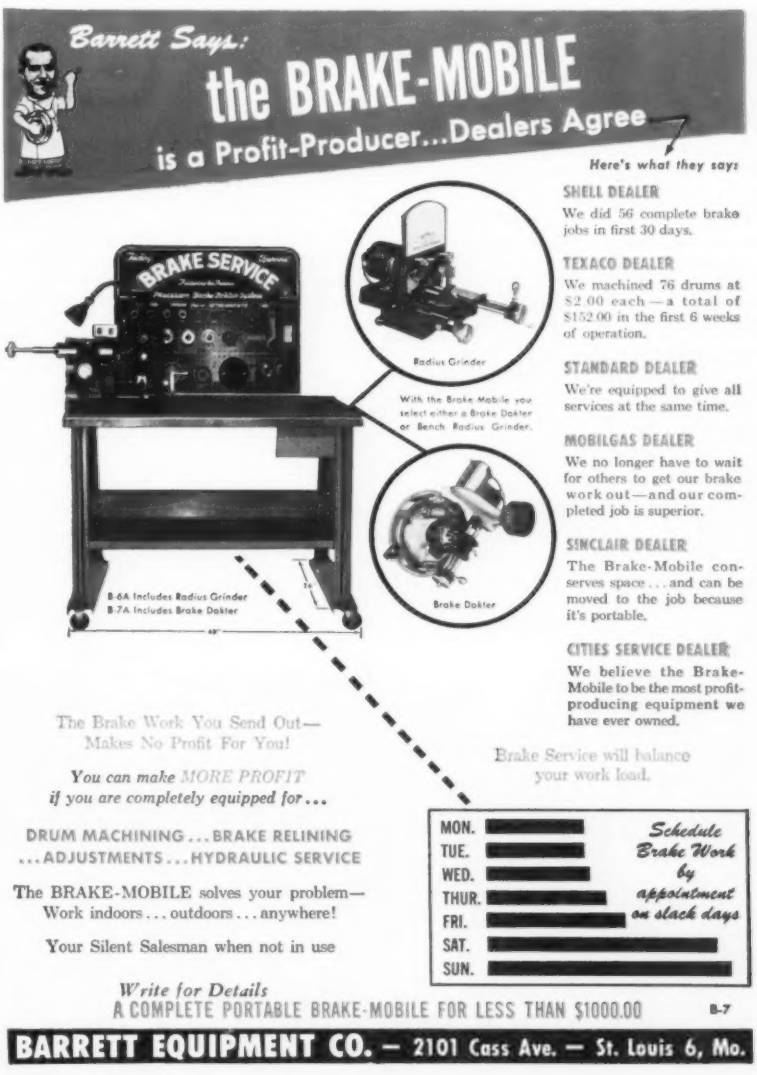
It has long been assumed that a corporation could redeem all the stock of an unrelated stockholder without tax problems. The redemption of all the stock of a stockholder not related to other stockholders is taxed at capital gain rates but the latest theory of the Tax Court and the Internal Revenue would make such a redemption a dividend to the remaining stockholders. See J. R. Holsey, 28 TC No. 107, Louis H. Zipp, 28 TC No. 32.

Don't Overlook Lubricating Antennae Pole Sections

Improper antenna pole operation may be due to a lack of lubrication between the pole sections and the pole seals, according to a recent Lincoln-Mercury service bulletin. This can be corrected by applying a silicon lubricant to the sections with the pole completely extended.

Run the antenna up and down a few times in order to allow the seals to become fully lubricated. The silicon lubricant will aid in sealing the pole sections against water and reduce the possibility of the pole freezing during cold weather. For best results, apply silicon lubricant three or four times a year.

To make your shop more profitable . . . your time more valuable . . . be sure to read this month's "These Are New" section


Barrett Says:
the BRAKE-MOBILE
is a Profit-Producer...Dealers Agree
Here's what they say:
SHELL DEALER
We did 56 complete brake jobs in first 30 days.
TEXACO DEALER
We machined 76 drums at $2.00 each — a total of $152.00 in the first 6 weeks of operation.
STANDARD DEALER
We're equipped to give all services at the same time.
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Screw-in type valve seat inserts

In today's modern, high-compression engines, valves must contact their seats around their entire circumference in order to insure a gas-tight seal and adequate cooling of the valves.

• SATISFACTORY OPERATION of a four-stroke cycle engine, and especially the modern higher-compression engine used in passenger cars, makes it imperative that the valves contact their seats tightly around their *entire* circumference. This ideal condition must exist not only from the standpoint of sealing, but equally important, to insure adequate cooling of the valves to the surrounding metal and eventually to the coolant in the water jackets.

Failure of valves to seat correctly leads to eventual burning, breakage and valve seat cracking. Excessive heat is the arch enemy of valves, and when an engine operates under load, terrific heat exists around the area of the exhaust and intake valve ports.

Heat causes metal to expand, and this expansion, in turn, causes actual movement of metal. Expansion is further increased if there is undue restriction by foreign matter in the engine's cooling system (Figs. 1 and 2).

PROPER COOLING FIRST REQUISITE

Engine parts suffer serious damage if subjected to excessive heat over an extended period. That's why it is so important to impress on customers the necessity of keeping the cooling systems of their cars' engines in a clean condition by periodic servicing. An accumulation of lime scale or other foreign matter actually insulates the metal against proper cooling, trapping the heat in localized spots. This often causes parts to distort, warp or actually break. Thus, a valve stem may warp, causing the head of the valve to tilt or cock, as in Fig. 3. This produces a local hotspot—the head of the valve—as the coolant is ineffective to absorb the excess heat. Obviously, efficient overall engine performance is seriously impaired in such cases.

The relationship of intake and exhaust valve ports to the cylinder wall is shown in Fig. 4. High engine temperatures caused by heavy load operation or by restrictions in the coolant circulation, cause metal movement at points A and C (shown by dotted lines). Inasmuch as the exhaust valve cannot properly seat under such a condition, there is blow-by of the hot exhaust gases. The action can be likened to that of a blowtorch, which in time will burn the valve. The alternate expansion and contraction in this area also may result in metal fatigue.

Eventually the thin-walled section between the two valve ports may be pushed towards the intake valve seat and thereby distort it. This action causes a gap to exist between the intake valve head and seat at point B, Fig. 4,

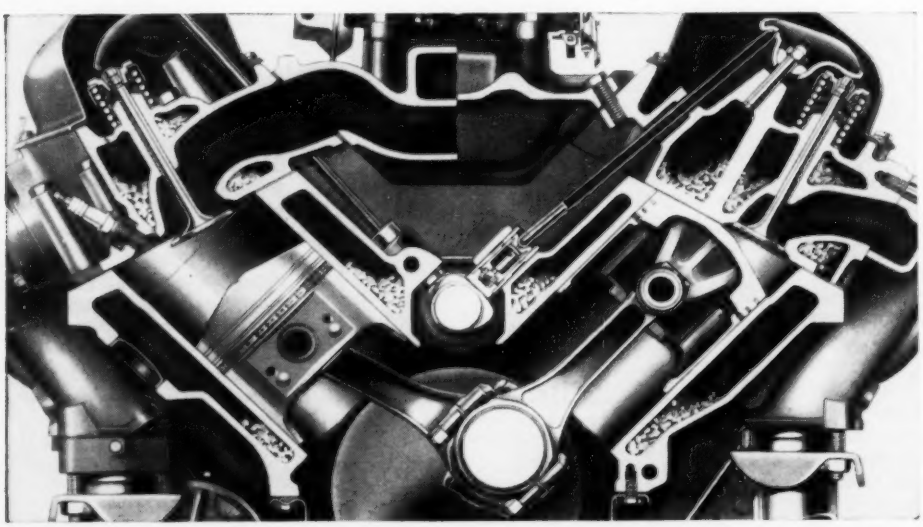

Fig. 1. Restriction of the coolant passages around the valve area may cause metal expansion, especially under heavy engine load and temperature conditions.

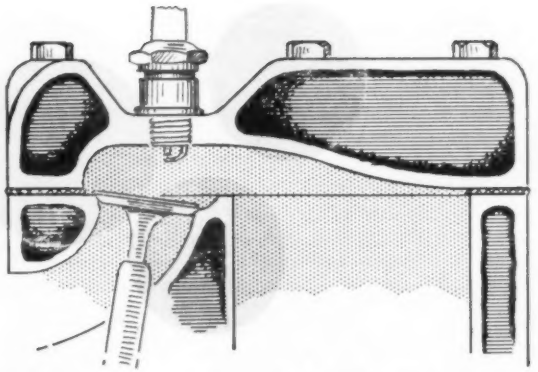

Fig. 2. Accumulation of lime scale and other foreign matter in the coolant actually insulates the metal against cooling. Valve seat distortion, valve warpage or breakage may result.

allowing the hot exhaust gases to materially increase the temperature of the intake valve seat.

Under a "no-load" operation, the intake valve cools quite rapidly, which causes contraction of its seat. This might well result in crystallization and valve seat cracking. The distortion also causes the intake valve to burn. It has been found through experience that in the majority of cases, valve seat cracking and burning takes place in cylinders 2, 3, 4 and 5 in six-cylinder valve-in-

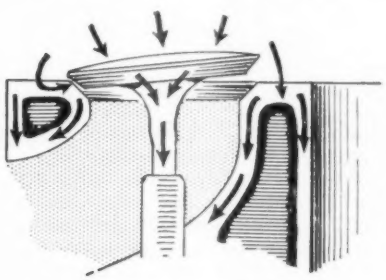

Fig. 3. How a warped valve stem causes failure of the valve to seat and also produces a hot spot. The coolant is ineffective to absorb access heat.

head engines, and in the middle two cylinders of the right and left banks of V-8, valve-in-head engines. The reason for this is generally attributed to the fact that the exhausts of these cylinders are channelled in pairs (Fig. 5).

The condition mentioned in the preceding paragraph is said to be prevalent in engines not equipped with valve seat inserts or in engines equipped with pressed-in type seat inserts. Instances have come to hand where some pressed-in seat inserts have cocked or tilted so they are high on one portion of their circumference. This naturally causes flexing of the valve head, bending, or actual breakage.

From the experience of engine rebuilders and shops doing considerable engine work, it appears that valve distortion problems can be substantially eliminated by

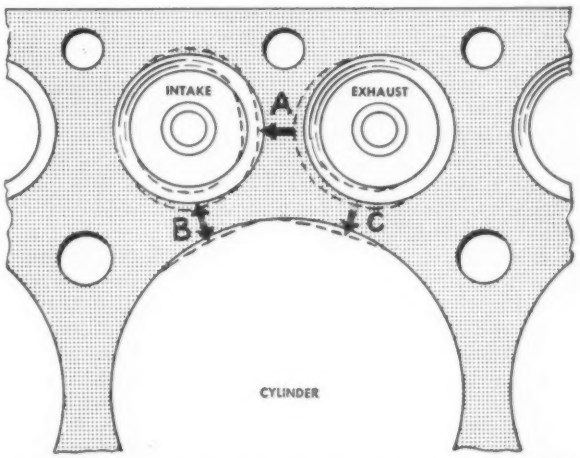

Fig. 4. Relationship of intake and exhaust ports to the cylinder wall, showing how metal movement under extreme temperature adversely affects the valve seats.

the installation, for example, of P-B special threaded-in valve seat inserts which have expansion clearance machined into the threads, as illustrated in Fig. 6.

The manufacturer of the threaded-in type inserts points out that due to the thread clearance, there is room for the insert to expand without affecting the surrounding metal. This expansion within the valve seat insert allows the latter to remain round. Obviously, the valve head under such a condition is given a much better chance to completely seat over its entire circumference and thereby prevent blow-by, as well as eliminating the possibility of developing local hotspots.

During installation, as will be noted from Fig. 6.,

(Continued on following page)

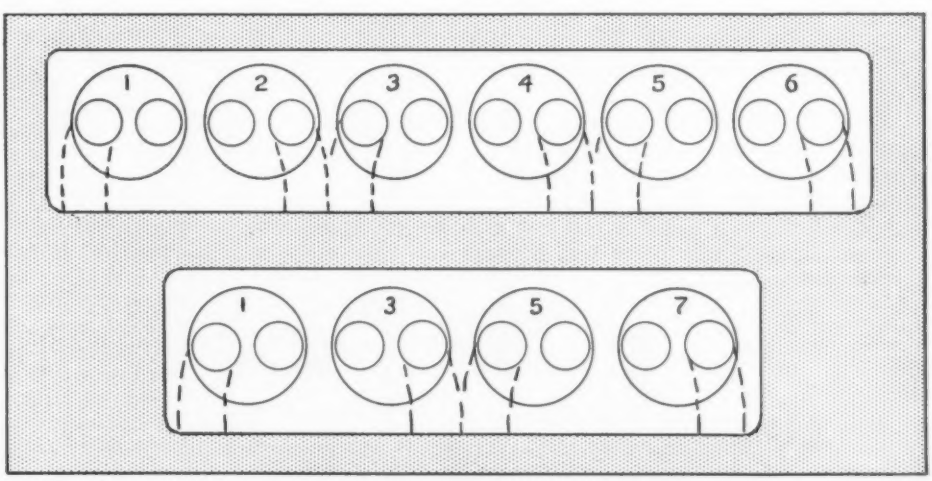

Fig. 5. Valve seat cracking and valve burning usually occurs in cylinders 2, 3, 4 and 5 of a six, valve-in-head engine and in the middle cylinders of the banks of a V-8 valve-in-head engine. Channelling the exhausts in pairs is the reason.

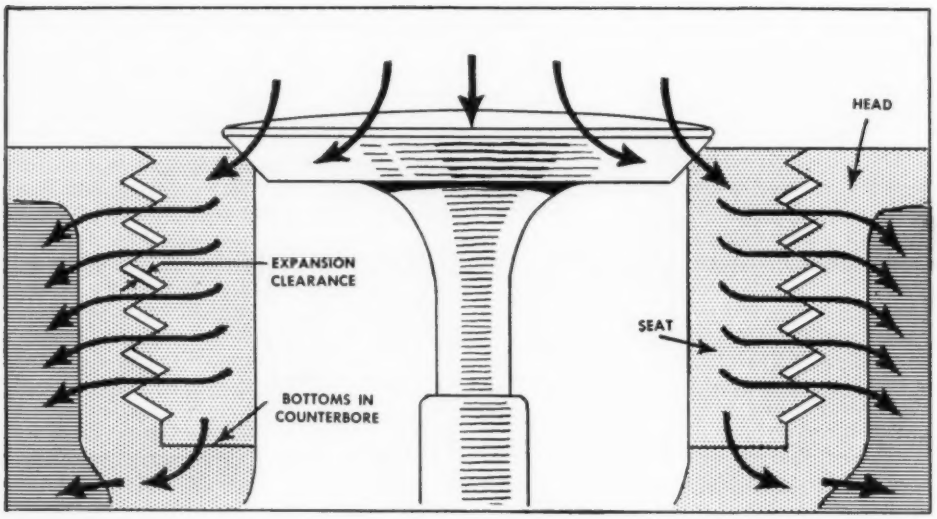

Fig. 6. Screw-in, self-locking insert with expansion clearance (.005-.007") machined in between threads. Latter affords greater heat conducting surface area to coolant.

Valve Seat Inserts . . . CONTINUED

when the threaded-in insert bottoms in the counterbore, the threads are vertically locked in place. This maintains a positive contact with the bottom of the counterbore so that it is virtually impossible for the seat to tilt or cock, or to come out. The screwed-in insert (stainless-alloy) remains hard under extremely high temperature conditions and transfers heat from the valve to the coolant through its entire circumference.

CENTERS ON VALVE STEM GUIDE BORE

As in the case of pistons, rings, con rods, bearings and other engine parts requiring machining or careful work, valve seating, too, is a precision job and must be centered around the axis of the valve stem guide bore as its starting point. Therefore, in the application of valve seat inserts it is essential that the bottom of the seat counterbore be exactly at a right angle (90°) to the axis or center line of the valve stem guide bore (Fig. 7). Only by obtaining this condition will the correct geometry of the related parts be reproduced.

This relationship can be accomplished, for example, with the equipment shown in Figs. 8 and 9. This insert

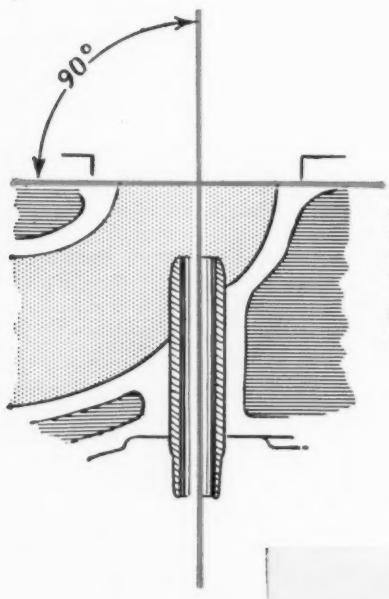

Fig. 7. Bottom of the counterbore must be exactly at right angles to axis of valve stem guide to insure correct geometry of related parts.

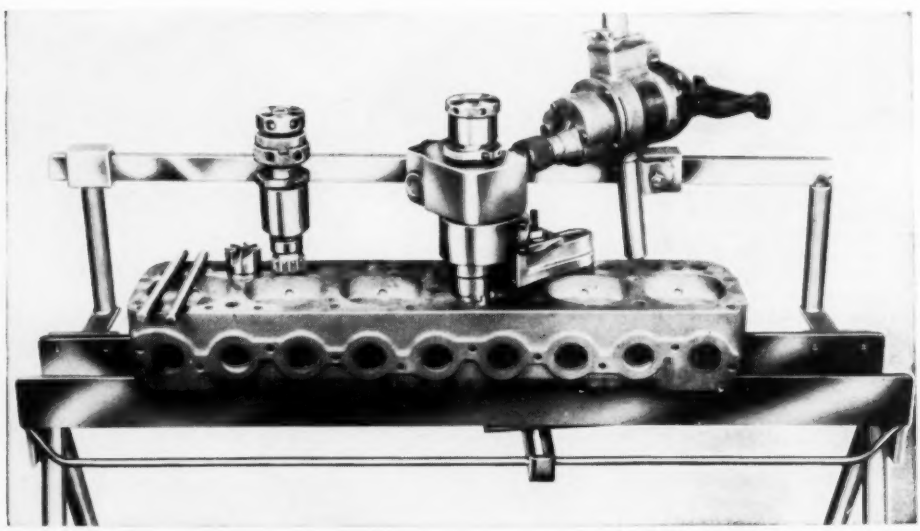

Fig. 8. Heavy-duty power unit used for cutting counterbore and machining off top of screwed-in valve seat insert.

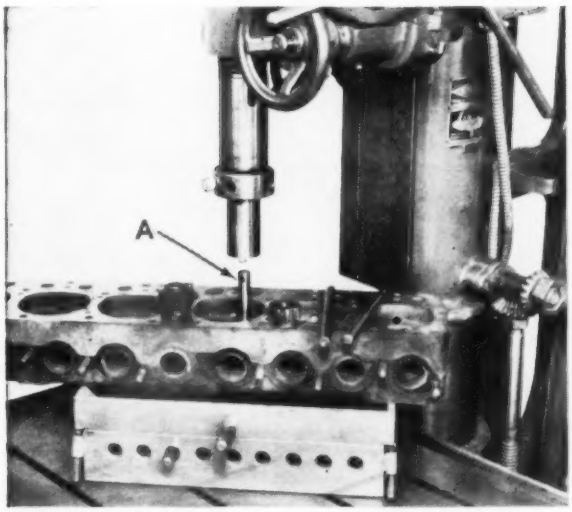

Fig. 9. Pilot (A) in place for tapping the previously machined counterbore with a lead screw unit. After tapping, the seat is screwed in place by hand.

installing equipment precision cuts the counterbore and threads in the block or head concentric with the center line or axis of the valve and its guide. The self-locking feature of the screw-in type insert is possible only when the bottom of the counterbore is at right angles to the center line of the valve stem guide bore and the insert threads are parallel to the bottom of the counterbore.

BETTER HEAT CONDUCTIVITY

After the counterbore has been cut the tap cannot be set for tapping (over the pilot and through the hold-down foot collar) if either the universal joint or hold-down foot has moved from its original position. Consequently, correct alignment always is maintained. After the threaded insert is screwed in, finger tight, downward pressure of the cutter when machining off the top of the seat insert centers and jams the seat between the bottom of the counterbore and the top of the threads. Thus the threads have greater heat conducting surface area than is possible with the straight sides of a pressed-in type seat insert.

Attention is called by the equipment manufacturer to the fact that no matter how deep the counterbore the screw-in seat insert has extra material at the top to be machined off after installation to original factory height, giving factory specified spring tension and timing. This insures that the valve will seat evenly and correctly on each of its strokes.

Press-fitting a valve seat insert necessarily applies radial or outward pressure at the time of installation. Due to heat expansion, the cylinder block or head (valve-in-head engines) are highly stressed by the expanding pressed-in seats and this, in turn, may cause cracks to be started. Under severe temperature conditions the excessive heat increases the tendency of the seat insert to expand, buckle or distort, which, of course, may lead to ultimate valve trouble.

Since no radial or outward pressure is exerted on the screw-in type valve seat insert, and because expansion clearance is built in, excessive heat does not cause such an insert to distort, according to the maker. Apparently this is substantiated by the experience of shops servicing engines, partcularly truck engines, over several years.

The heavy-duty power equipment (Fig. 8) is said to materially speed the cutting of the counterbore and machining off the top of the insert after installation. It drives cutters from 1″ to 4″ in diameter. A hand-operated unit also is available for counterboring and tapping, but this obviously is somewhat slower in action but fully as efficient for boring and precision thread cutting.

The hardened, long wearing cutters and taps are available in steps of 1/16″ from 1″ to 4″ diameter. A new seat can be installed in the same counterbore, when desired, without going to an oversize and this can be done several times. The heat-treated, solid .002″ taper pilot will break, the manufacturer states, before allowing a misaligned cut to be made.

Proper Aiming of Dual Headlights Stressed in New AMA Guidebook

Properly aimed, the new dual headlighting system gives night-driving motorists the best roadway illumination yet achieved by automotive lighting engineers. "But all of these improvements can be thrown away because of poor aim," declares the Automobile Manufacturers Association, in their latest booklet, *Aiming the Dual Headlighting System.*

The "how-to-aim" booklet points out that different procedures must be used in aiming single and dual unit systems. It shows, however, that with the new mechanical aiming devices, headlamp aiming today is relatively simple. The book also describes headlamp design, explains the need for accurate aiming, and briefly reviews the history of headlighting progress.

For a copy of the booklet, send your request to the Automobile Manufacturers Association, Dept. ASD, 320 New Center Bldg., Detroit 2, Mich.

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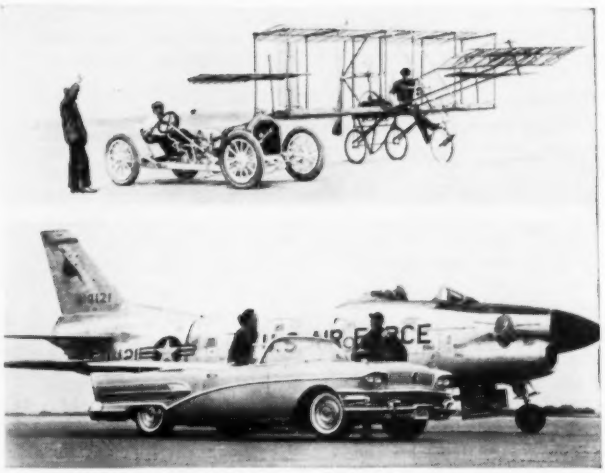
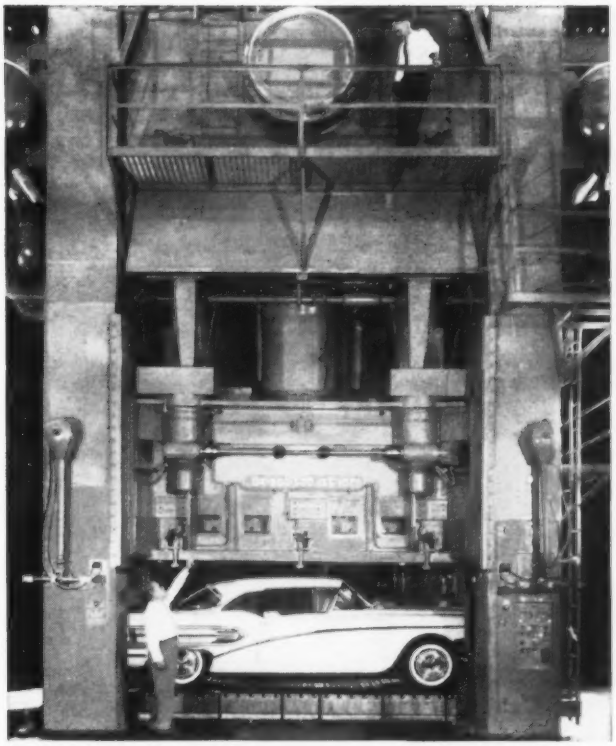
PHOTOS
from here and there



Dramatic strides made in automotive and aviation design over the past half-century are illustrated in these two pictures. The upper photograph, taken in 1908 when General Motors was founded, shows the start of a race between a stripped-down car of that year and a flimsy biplane of the same vintage—a race which the car won, incidentally. The 1958 convertible and F-86D Sabre Jet (below) show the racy styling and sleek lines which characterize their modern counterparts.

A balloon, a piece of tape, a hat pin and reactions of Firestone's Barbara Hardy combine to illustrate the advantages of tubeless automobile tires. Tape in the upper left panel simulates an inner liner of a tubeless safety tire. The pin-bearing balloon (upper right) shows how a tubeless tire holds air even when punctured. The bottom two panels illustrate what is likely to happen when the tube of a conventional tire is punctured.

The "Astropod" and jet thrust tubes of Studebaker-Packard's "Astral," created in a styling idea project, are shown by model Barbara Dixon. The "Astropod" was designed as a power receiver to take beams of ionic or nuclear force and convert them to jet thrust through a battery of tubes. The "Astral" was designed to stimulate new approaches to automotive styling, influenced by the space age. Such projects often result in accessory or single feature design that may be adaptable to production models.



Engineer's dream?—Making a complete car in a single stroke is just an engineer's dream, even though this gigantic press installed at Buick is big enough to cradle a complete car in its 75-ton die bed. Weighing nearly 700,000 lb. and capable of exerting 800 ton pressure, the press will be used to form hoods. It stands 46 ft. high, including a 13 ft. foundation.

The recently opened greater New Orleans bridge, longest cantilever highway span in the world, utilizes more than 600,000 lb. of aluminum in railings, lighting standards, access stairways, grating and other applications. The 52 ft. wide span will be divided into four 12 ft. wide lanes, and is expected to bear 8-million vehicles during its first year of operation.

Automotive Clinic . . .

(Continued from page 6)

was found that the required voltage on 4 cylinders was from 15,000 to 21,000 volts whereas the voltage should not have been over 5,000. Changing plugs took care of the trouble which was due to open resistors in the resistor type plugs.

The possibility of open resistors on plugs that have seen considerable mileage should be kept in mind, and in cases like this, test to see if the ignition is at fault. If an oscilloscope is not available, an ohmmeter can be used to test the plugs by connecting the meter from the plug terminal to the end of the center electrode. The reading should not be over 15,000 ohms. If it is higher, discard the resistor plug and replace it with a new plug.

Apparently the resistance in the plug is somewhat reduced when cold so that enough high tension current can get through to fire the plug, but when it gets hot the gap expands due to heat or the resistance increases due to temperature so plug will not fire.

Another Hard Starter

Am having starting trouble on a customer's '51 6-cylinder Chevrolet (with Powerglide transmission) when the engine is hot. It starts fine with the engine cold, but when the engine gets up to normal operating temperature the starter turns over very slowly. A complete electrical check showed everything to be in order.

After the engine is warm it seems to get tight or hard to turn over. If you take out all the spark plugs, you can turn the engine over with the fan belt, but it is very hard to do. However, you can drive the car all day and engine temperature stays at 160°.—*R.D.C., Deshler, Ohio.*

Answer: The fact that this car can be driven all day without its getting hot would seem to indicate that the trouble in starting is not mechanical. If there was binding or tightness, it would show up in long fast drives. Therefore, the trouble must be either in the starting motor, in the wiring or in the starting relay.

Put an ammeter in the starting motor circuit and see whether the current for cranking is over 150 to 175 amperes. If it is, it means the trouble is mechanical. Using your voltmeter, check for any voltage drops over .2 volt anywhere in the relay or cranking circuits. Also check the voltage drop at both battery terminals. We believe this will reveal the cause of your trouble.

Check battery voltage while the cranking motor is turning for 15 seconds. There should not be a drop of over 1 to 5 volts on a 6-volt system. If the voltage goes below 5 volts, check the battery more thoroughly.

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Hard Shifting Overcome by Replacing Outer Shift Lever

When owners of 1958 Studebaker Champion models equipped with the T96 overdrive transmission complain of hard shifting into reverse gear when the overdrive control button is in the "IN" position, the factory recommends the installation of the new type Low and Reverse Outer Shift Lever (Part No. 1546796) and the new type Low and Reverse Shift Lever Shaft Assembly (Part No. 1547057).

The new outer lever has the rectangular opening for the shift shaft moved 16° clockwise which places the outer lever in a more desirable position from the standpoint of mechanical advantage. The cam of the new inner shift lever shaft assembly has a wider face so that it fully contacts the end of the reverse shift thereby eliminating the possibility of a bind which contributes to hard shifting. The contour of the cam has been changed to further reduce the shifting effort into reverse.

The new shift lever and shift lever shaft assembly are to be used on the 1958 models only.

Instrument Corner . . .

(Continued from page 8)

and it was discovered that the coil polarity was wrong again.

After thinking this over for a moment, the Instrument Man asked, "Did you check the ground resistance between the regulator and body?" Receiving a "no" for an answer, the voltmeter was brought out, and sure enough— there was over 0.5 voltage drop at this point. To correct the bad ground, a ground wire was run to the fire wall and anchored with a self-tapping sheet metal screw with the other end under the hold-down screw that anchored one end of the regulator base. Then the high tension polarity was checked again and corrected by reversing the coil connections.

"I think you fellows need a little lecture on the effect that a poor regulator ground can have," chuckled the Instrument Man, "so get your partner over here and listen." Then he went on to explain.

UPSETS NORMAL CURRENT FLOW

"A poorly grounded regulator can upset the normal flow of electricity in some of the car circuits. For example, when the lights, heater motor, or cigar lighter are turned on, they will try to find the ground of least resistance, which may be the field circuit of the regulator. This causes the generator to reverse its polarity, which in turn will reverse the coil polarity when the engine is running and also keep the battery from charging.

"The field circuit back to the field winding of the generator, and finally to the armature, is at most a weak voltage and low current circuit. When the headlights or heater motor on the firewall are fed a stronger battery-voltage current, it may flow into the common ground of the regulator, thus forcing a reverse flow in the field circuit. This will change the generator polarity.

TWO SOURCES OF ELECTRICITY

"You must remember, there are two sources of electricity on the vehicle— the battery, and the generator. They are both supposed to have a common ground; but the generator has its own ground circuit and the battery has its own. Where the battery may be grounded to the engine the lights and accessories are grounded to the body, and if the ground from body-to-frame-to-engine is not as good as it should be, the field circuit of the generator is pressed into service. This naturally upsets the function of both the regulator and the generator.

WHAT TO DO

"So here is what to do to see if the regulator is well grounded: Connect the voltmeter to the base of the regulator and the frame of the generator. Have 20 amperes flowing on 6-volt systems, or 10 amperes on 12-volt systems, which should result in less than 0.1-volt drop, as shown on the voltmeter. In case the ground is sufficient for this load, be sure about it by turning on all the lights, heater, defroster fan, radio, and if possible, have someone push in the cigar lighter; and again check the voltmeter for a reading. If the voltage indication increases, be sure to put on an additional ground wire.

"Unless there is something else wrong, your customer will like the way his car acts now, and he will give you boys credit for "knowing your stuff."

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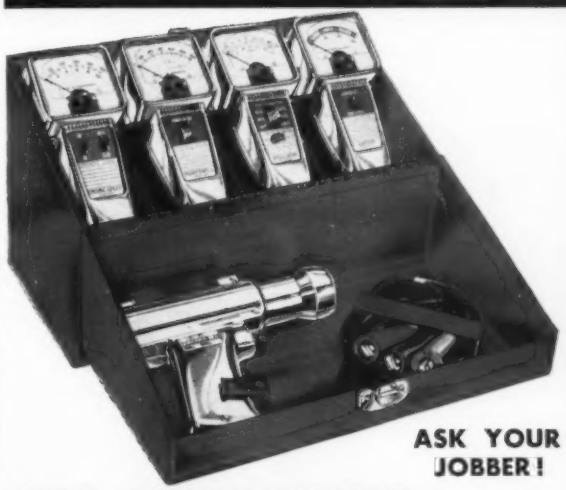

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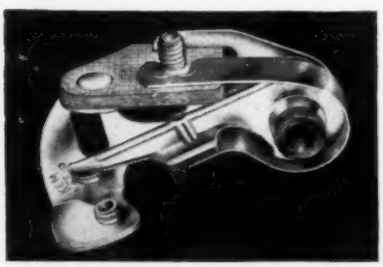
1-Piece Point Sets

Kem's line of 1-piece Vent-O-Lated points has been expanded to provide full coverage for all Delco-Remy, Auto-Lite and Ford installa-



tions, so that 12 sets now do the job of 20—which means a reduced inventory with a smaller initial investment.

The new ventilated contacts are said to insure dependable performance and longer point life. The contact arm and tungsten surfaces are protected from mishandling and distortion during installation because the components are completely factory pre-assembled and aligned to drop easily into place in the distributor.

(Use Reply Card for Further Information)

Unbreakable Ball Peen Hammer

A new ball peen hammer, guaranteed unbreakable forever, is announced by the Owatonna Tool Co.

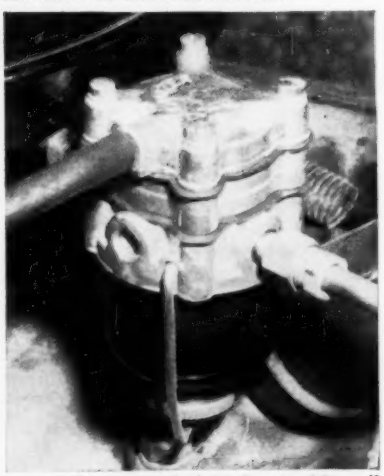
With head and handle forged in one piece from fine tool steel, there are no welds, joints or pins to loosen or break.

The laminated grip is genuine sole leather which the manufacturer states will not loosen from the shaft, and is said to be unaffected by sweat, gasoline or oil, under normal conditions.

(Use Reply Card for Further Information)

Fuel Pressure Regulator

A new automotive fuel control—designed to save gas, boost engine performance, stop flooding and stalling—is announced by AC Spark Plug Division of General Motors.



The device, called "ACon-o-Mizer," is a fuel pressure regulator, which is mounted between the fuel pump and carburetor, and designed to cut fuel pressure when it should be cut—at idling or normal cruising speeds—and increase pressure when it is needed for extra bursts of power.

Without the regulator, gasoline is pumped to the engine at a pressure of up to 6½ p.s.i. when idling. The regulator, however, reduces this idling pressure to 1¾ p.s.i., which is said to virtually end flooding, stalling and the fuel waste that go with those conditions.

(Use Reply Card for Further Information)

Cleaner Dispenser

A new dispenser for their hand cleaner is now available from Mac's Super Gloss Co. The dispenser is said

to eliminate waste and cut a shop's hand cleaner bill 60% by measuring out the correct amount of cleaner each time. The cleaner itself is waterless and contains special solvents that clean gently but thoroughly . . . plus soothing lanolin.

(Use Reply Card for Further Information)

No-Load Finishing Paper

Armour No-Load finishing paper is said to be ideal for sanding of soft materials such as paints, lacquers, enamels, plastic and fibreglass. Unlike ordinary coated abrasive products, No-Load paper has a special coating which is said to prevent residue from loading and clogging—the user merely has to slap the paper to dislodge the residue.

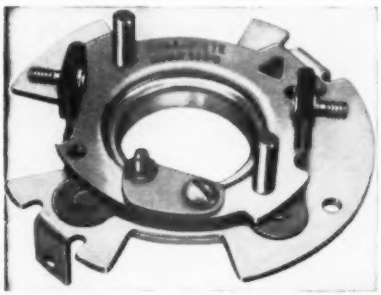
In addition, No-Load paper has a tough and flexible backing which prevents slipping in the operator's hands, and the manufacturer states that the use of water is not needed to obtain smooth-as-glass finishes.

(Use Reply Card for Further Information)

New Dyna-Flyte Model

Renberles Products announces the addition of a new model to their line of Dyna-Flyte ball bearing distributor plates — this one for servicing the 1957-'58 Auto-Lite 8-cylinder distributor.

A feature in their design is a special



linkage device which is said to transpose the same vacuum curve to the concentrically mounted Dyna-Flyte ball bearing plate as established by the eccentrically pivoted original equipment friction plate. This new design permits the use of a precision ball bearing, either single or dual points, and only one model to service all 1957-'58 Chrysler products, except New Yorker and Imperial, which use a dual point ball bearing plate as original equipment.

The manufacturer states their precision plate provides constant cam angle and friction-free spark advance, plus increased coil saturation for a stronger spark, over the entire engine range. They claim easier starting, smoother idle, faster acceleration, improved economy, and better overall performance.

(Use Reply Card for Further Information)

Valve Guide Seal

Valve seals designed to eliminate oil loss through valve guides in overhead valve engines by forming a positive

seal between the valve stem and guide, are now available for popular makes of trucks and automobiles from the Perfect Circle Corp.

The new valve seal, which consists of a Teflon seal encased in a Buna-N synthetic rubber jacket with a retainer ring, has been two years in development and grew out of the company's continuing study of oil control problems in modern, high compression engines.

(Use Reply Card for Further Information)

"Triple-Action" Parts Cleaner

The "triple-action" SPD Parts cleaner developed by Gumout Division, Pennsylvania Refining Co. combines solvent, penetrant and detergent action for the greatest possible speed in cleaning all types of metal parts.

The maker says the solvent action dissolves and completely removes accumulations of gum varnish, oil and grease. The penetrant action pierces and lifts the hard caked-on deposits. The detergent action floats away the common dirt, soil and grime.

Other outstanding features include minimum odor that "doesn't go home with you"; longer life (is said to outlast ordinary cleaners up to 100%); hydro-seal layer prevents evaporation; and the cleaner will not rust, corrode or leak out of the container. SPD is non-explosive and non-inflammable . . . and is said to strip off paint in a jiffy.

(Use Reply Card for Further Information)

Auto-Lite Announces New Battery with Power Bond

An automotive battery said to "eliminate mechanical failure in even the most severe service" has been developed and is being marketed by The Electric Auto-Lite Co. It is new battery engineering concept based on the development of a one-piece battery construction with complete resistance to the effects of severe service abuse. Named the Auto-Lite Stapower Bond, it carries a 50-month guarantee. Owners will receive a personal guarantee card that will be honored by Auto-Lite battery dealers anywhere in the world.

Significance of this new battery to car owners, Auto-Lite reports, is that it eliminates the power-robbing effects of rough road, railroad crossing, unusual service and normal driving vibrations that shorten conventional battery life.

ONE PIECE COVER welded to case seals liquid in, gives maximum case strength
PERMANENT INTERCELL BOND isolates each cell, prevents power leakage over connectors, maintains higher starting voltage
PERMANENT SEAL prevents acid leaks and top-of-battery corrosion, protects battery life
INTERCELL CONNECTORS permanently protected from power-robbing leakage and battery-killing corrosion
POWER BOND resin anchors power plates to prevent vibration wear, the major cause of battery failure
AUTO-LITE
stapower

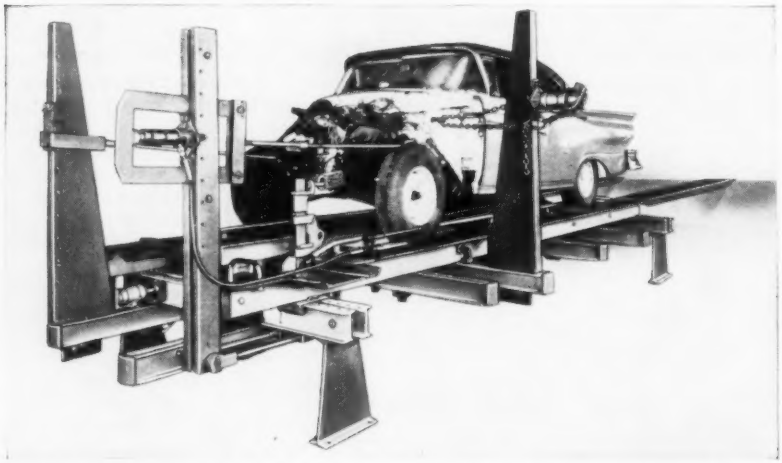
Comparison tests showed that the Power Bond construction eliminates plate-destroying vibration. Conventional types of batteries subjected to vibration tests by Auto-Lite failed after 55 hours of testing. The Power Bond Battery showed no damage after 1,000 hours of identical testing, it is said. Auto-Lite cites a specially developed seal that welds the Power Bond plates and battery case into a rigid shake-proof unit to prevent mechanical failure.

Engineering features of the new battery include a one-piece cover welded to the case for maximum case strength; a permanent seal that prevents acid leaks and resultant corrosion; a special Power Bond resin that anchors power-producing plates to prevent their destruction by vibration and a permanent intercell bond that isolates each cell and maintains higher starting voltage.

A rather novel feature of the new battery is its color. Instead of the usual black, the new Power Bond is a striking white with touches of gold and red.

(Use Reply Card for Further Information)

These are new *manufacturers' products*



Dual Body-Frame Straightener

A new dual body and frame straightening machine has been announced by the Bear Manufacturing Co. which makes it possible for repair shops to correct both frame and body damage at the same time through the use of new "Power Towers" and specially engineered attachments.

Developed through months of practical, on-the-job testing and refinement with leading car manufacturers and insurance companies, the new machine not only affords amazing power and easy hook-up for the toughest frame and body work, but it also places in the operator's hands the exclusively designed Bear tools to do a complete job of frame correction and body rough-in at one time—while the vehicle is on the machine.

The rack itself is 20 ft. long and 112 in. wide with two Power Towers which are movable and attach to the rack step beams and transverse beams for any between-the-runways or side pulls. The Towers extend to a height of 54 in. above the runway and permit pulling at various levels, and angles to reach practically any section of the car body. The other Power Tower runway standard is attached with two tension rods for setups in line with the runways at either the front or rear of the vehicle. Runways are adjustable to any car width to handle both small foreign cars as well as conventional size automobiles.

(Use Reply Card for Further Information)

Automotive Vacuum Cleaner

This new Doyle Model 6-D Vac-It has been designed to give service shops a low priced, modernly styled vacuum cleaner with greater portability and adequately powered to provide long, hard service. Among its features is a clean-line head assembly with cast aluminum alloy ring which diffuses exhaust air downward around its complete circumference. Integrally-styled into the satin-finished head ring are cast latches which permit quick, easy removal of the head and filter assembly.

This machine has a weather-protected ¾ h.p. motor, cradled in rubber for quiet operation and impact-damage resistance. Dirt, dust and litter is drawn into a 5 gallon recovery capacity, heavy gauge steel tank through a splash-free cast intake deflector. Fast cleanout is assured by a completely smooth tank interior, and the tank itself lifts free of the dolly in a single motion.

Big wheels, twin "sure-track" casters, and sturdy rubber-grip dolly handle make for easy portability. You can push it, pull it by the hose, or guide it with better maneuverability and without tipping, over gravel drives, stairways, ramps, or curbing.

(Use Reply Card for Further Information)

Cylinder Deglazer

A self adjusting surfacing hone for deglazing cylinders from 2" to 7" diameter is announced by Clark Feather Mfg. Co.

Designed to fit any ¼" or larger drill chuck, the hone offers a choice of 220 or 400 grit abrasive cutting stones and uses two stones and one felt wiper shoe. Each shoe (or head) is swivel mounted and quickly replaced. The felt wiper is used to carry oil to cylinder bore and to clear cuttings away from cutting stones.

The tool has a flexible joint in the drive shaft for self centering and for work in cramped engine compartments; box-section reverse-curve arms give maximum strength. An exclusive T-slot spider transmits the drive torque from the shaft to the arms without binding and with equal cutting pressure at all diameters and regardless of drive speed. A single tension spring assists centrifugal force and makes one-hand insertion of tool into cylinders easy.

(Use Reply Card for Further Information)

Limited Slip Differential Lube

The limited slip differential available on many 1958 automobiles requires a highly specialized lubricant to assure proper functioning at all times. To meet this demand, Amalie Division, L. Sonneborn Sons, Inc., has formulated a new lubricant especially for use in these differentials.

Known as L.S. Gear Lubricant, it is available in 400 lb. and 100 lb. drums, and 35 lb. pails.

(Use Reply Card for Further Information)

Hinge-Handle Ratchet

Newest item in the Bonney tool line is this hinge-handle ratchet which allows up to 30° movement in either direction, making it possible to bypass obstructions that would prevent

the use of the conventional ratchet. Other features incorporated into the tool are a replaceable head unit (which allows "on the spot" repairs by merely removing a snap ring, dropping out the damaged unit, and inserting a new unit), and a friction action handle which enables the mechanic to work the tool into close quarters without losing the degree of angle.

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- ☐ "Triple-Action" Parts Cleaner
- ☐ Auto-Lite Has New Battery
- ☐ Dual Body-Frame Straightener
- ☐ Cylinder Deglazer
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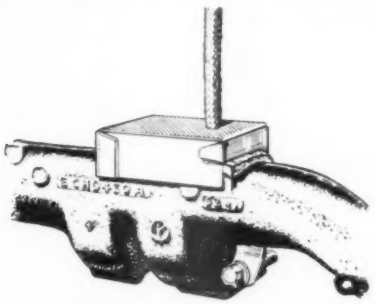
Choke Stoves for Chrysler Cars

Brake Parts Specialty announces the addition of models of their Choke-Stoves for use on all 1955-'57 Chrysler products to replace the original



equipment carburetor heat tube — which, according to the manufacturer, has an unpleasant habit of breaking off inside the manifold at about 10,000 miles to damage the carburetor by plugging air passages and jets with carbon and dirt.

With a Choke-Stove installed *on* the manifold, the problem of a sticking choke, plugged passages, wasted gas and carburetor failure are said to be eliminated. Since it does not obtain its heat from inside the manifold (as the original heat tube does) no carbon or dirt can enter the carburetor through the unit.

(Use Reply Card for Further Information)

100% Power Tire Changer

Using muscle power to change tires is said to be completely eliminated by a new 100% power tire changer recently announced by the Bishman

Mfg. Co., which uses air power for breaking beads and electric power for removing and mounting tires from 12" through 17½".

The electric power driven rotating arm uses the principle for mounting and demounting tires that has been used for many years on the company's Model 880 Tire Changer. The air power double bead breaker that is built into the new machine uses the "rolling action" principle to break both beads and roll them into the well in the rim. Power is supplied by a large air cylinder operated by applying an air hose to a valve in the handle, and is said to provide enough pressure to break the tightest beads. When not in use the upper bead breaker arm tips back out of the way.

Another feature said to make the new machine unusually versatile is the self-centering wheel chuck. The chuck jaws engage the rim and therefore do not require a center hole to hold a wheel.

(Use Reply Card for Further Information)

Engine Conditioner Chemicals

RSA Products Co. announces a line of automotive petroleum conditioning chemicals for use in all internal combustion engines.

Speedy Tune, applied by metering through carburetor venturi is a combustion chamber scavenger, which is said to remove all types of deposits from the combustion chamber and

intake manifold. The *Combustion Chamber Conditioner* is a smaller container of the same material as Speedy Tune, and is applied directly from container.

Crankcase Conditioner is said to have all the necessary qualities to reduce wear on high lift cams, rings, pistons and bearings, as well as improve cleansing properties of all oils.

Fuel Conditioner and Valve Lubricant, when added to the gasoline in the tank, is said to effectively reduce gum precipitation and keep carburetor jets free, in addition to scavenging the combustion chamber and protecting the entire system from rust.

Manifold Heat Control Valve Solvent and Penetrating Fluid is compounded of penetrating oil plus colloidal lubricants to assure long life for all heat riser valves, when applied every 1,000 miles; equally effective for loosening and lubricating all threaded fittings.

Gum and Sludge Remover: According to the manufacturer, engines seized with glycol contaminated oil can be relieved without dismantling by placing solvent in crankcase and letting it stand for one hour. When used in ratios of one to three with light oil, cleans all oil lines, rings and ring lands. Contains anti-corrosion and anti-scuff agents which are said to prevent wear of bearing areas.

(Use Reply Card for Further Information)

New Impact Wrench

Two new light-weight, small size impact wrenches rated at ¾" nut setting capacity are now available from the Gardner-Denver Co.

Model 18B-7 is equipped with ¾" square drive and Model 18B-7S has ⅝" built-in hexagon slip chuck. Accessories for the wrench include stud drivers, socket adapters, hexagon shank socket holders, and universal joint socket adapters.

(Use Reply Card for Further Information)

Magnetic Key Inserter

A redesigned magnetic key inserter for replacing split valve keys is now

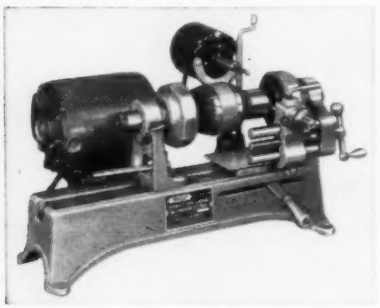
being offered by the Zim Mfg. Co. Made of non-magnetic stainless steel, the tool has two permanent magnets attached to the jaws which hold the keys firmly in position while inserting them into the valve stem.

(Use Reply Card for Further Information)

These are new *manufacturers' products*

Motorized Undercutter

The Trucut Armature Lathe and Undercutter now has a motorized undercutter which eliminates the time



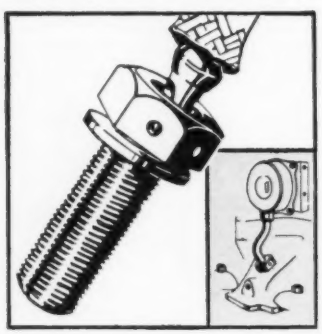
and trouble of changing belts for the undercutting operation. Designated as the Model B-15, the new unit is the same as the Model B-10, except for the direct motor driven undercutter. For those wishing to convert their present equipment, a motorized undercutter assembly is available.

(Use Reply Card for Further Information)

Choke Tube Repair Kit

Designed to overcome and forever eliminate sticking chokes and their resulting hard starts, carburetor failures and wasted gas, a simple, low-cost Choke Tube Repair Kit is announced by Houser Engineering & Mfg. Co.

According to the manufacturer, this



heater tube replacement will never burn out and is quickly installed without removing manifold—requires only a single hole to be drilled and tapped . . . heat element is screwed into the manifold, the copper line is seated in it, the top of the line then inserted into the automatic choke inlet, and secured with a nut. The burned-out choke heater tube is plugged and pinched, and left in place.

When installed, the choke tube repair kit closely duplicates action of original equipment. The asbestos-sheathed heat-conducting copper tubing affords rapid heat transfer, eliminating excessive fuel consumption and providing lifetime efficiency. The heat element, extending into the intake manifold, picks up the heat from the exhaust by-pass passage, transferring the heat to the air flowing within the element. Air flowing in from passages in the head of the element moves downward, is heated and drawn up through the copper line by the vacuum effect of the automatic choke.

One model fits Ford products . . . '56 through '58 Ford, Mercury and Thunderbird using a throttle mounted automatic choke, and drawing its heat source from a choke heater tube, mounted through the intake manifold.

(Use Reply Card for Further Information)

Coil-Condenser Ignition Tester

The King Electric Eqpt. Co. has introduced a Model 403, coil-condenser-ignition - resistance tester with which it is said to be possible to handle all ignition testing required on passenger car, truck, farm equipment and marine engines. The manufacturer adds that coils and condensers may be tested either on or off the engine, and that defective distributor caps, rotors, high-tension wires, etc. are immediately indicated by measuring and comparing ignition current flow at each plug with the engine operating. It is also stated that an ohmmeter scale allows for measuring resistance from 0-100,000 ohms for checking radio suppressors, resistance plugs, etc.

(Use Reply Card for Further Information)

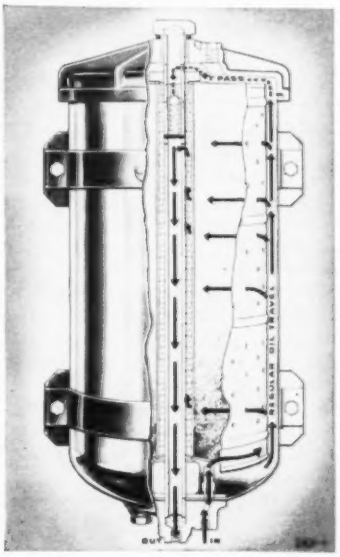
Diesel Oil Filter

A new, advanced-design oil filter for all heavy-duty diesel-powered engines was announced recently by De-Luxe Products, Inc.

The design of the new filter, called Graduflo HL and HS, is based on the company's fleet-approved regular oil filter which is said to have provided superior oil filtration at lower cost to 1 out of 4 trucks on the road today. The same high filtration efficiency is claimed for the new unit, although of a completely different type and design.

In addition to the Graduflo Filter, DeLuxe is introducing a brand new Graduflo Cartridge which is designed to not only operate in the Graduflo Filter, but is also designed to fit and improve the performance of other makes of diesel oil filters.

Among improvements are an "All



Weather" relief valve which lets oil warm up rapidly, insuring even pressure inside the filter regardless of pressure developed. Cold oil cannot enter the cartridge, is directed back to the crankcase to warm up quicker. Thus, cartridge contaminants cannot be squeezed back into the oil stream, it was pointed out.

Other claimed design improvements include: (1) specially placed removable inlet ports which permits oil to enter without agitating accumulated sludge in the sump; (2) higher than average filtration efficiency due to the staple cotton fibres, which are said to absorb 5.25 their own weight in contaminants—including acids, moisture, suspended particles and colloidal impurities.

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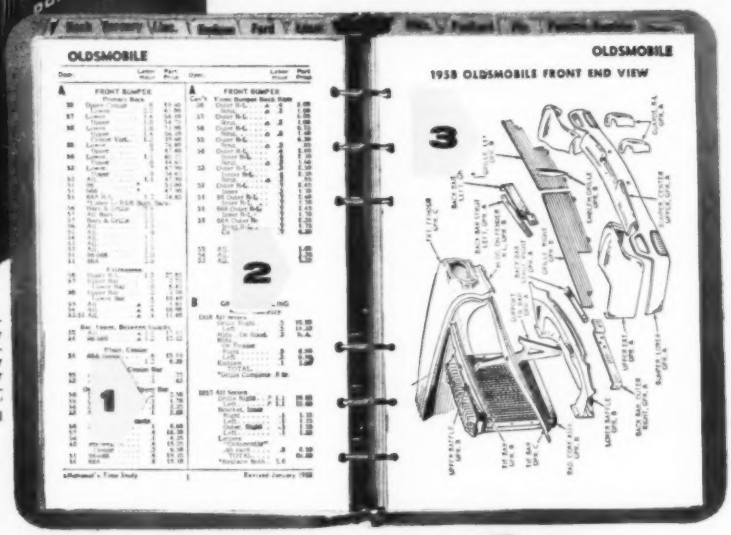

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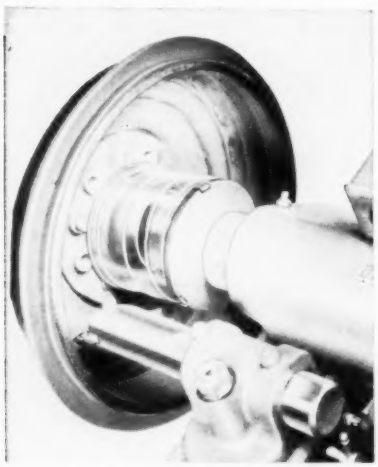
These are new *manufacturers' products*

Drum Lathe Chip Shield

Barrett Equipment Co. announces a transparent chip shield to keep chips and grinder dust out of hub and bear-



ing cup when turning brake drums. The shield, which fits over lathe arbor against inner face of drum, can be used on all makes of drum lathes using a 1" diameter arbor.

(Use Reply Card for Further Information)

Clogged Air Cleaner Alarm

Robertshaw-Fulton Controls Co. announces the development of a vacuum switch with dashboard warning light that automatically signals when the new paper-type air cleaners become

so clogged with dirt that excessive vacuum is built-up in the intake manifold to cause inefficient engine operation.

The switch is small and, although light in weight, is constructed to withstand severe engine vibration. It is completely enclosed in a corrosion resistant case, protected from dirt and moisture, and may be mounted in any position on the engine by means of a ¼" male pipe threaded boss.

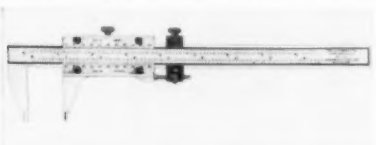
The sensing diaphragm of the switch is made of an oil resistant synthetic material, capable of accurate calibration over a temperature range from —40°F. to +250°F. All switches are factory adjusted in a range of vacuum levels.

(Use Reply Card for Further Information)

6" Vernier Caliper

The Starrett No. 123 satin chrome master Vernier caliper is now available in a new 6" size which offers all the features of 12" and 24" models; such as greatly improved, easier, faster reading with maximum accuracy, rigidity and long life.

New long 50-division Vernier scales



with widely spaced, easy-to-read graduations makes possible greatly simplified settings and readings without the use of a magnifying glass. This feature permits just half as many bar graduations as conventional single or double Vernier tools, a further asset to fast, accurate readings.

The open-face design also makes possible two Vernier scales on one side of the gauge for inside and outside measurements, thus allowing both Verniers to be read without turning the tool over.

Starrett's satin chrome finish on all reading surfaces makes reading easy, and surfaces are hard chrome plated for resistance to rust and stain.

(Use Reply Card for Further Information)

Valve Seat Inserts

Aluminum Industries, Inc., announces a complete line of Permite valve seat inserts for replacement service. The inserts are color-keyed for easy identification and individually packaged in hermetically-sealed plastic bags to keep them free from dust, dirt, rust and corrosion.

The inserts are available in three types, each of a different material. The I-1000 series, made of molybdenum alloy, is recommended for engines not originally equipped with valve inserts. These inserts are coated with green dye on the outside diameter for quick selection.

The I-3000 series, chrome cobalt alloy coated with blue dye, is used in heavy-duty engines that were factory-equipped with this type of insert.

The I-7000 series, of chrome molybdenum alloy, coated bright red on the outside diameter for ready reference, is manufactured for heavy-duty use in engines which operate under severe conditions.

In almost every instance, the inserts in the I-3000 and I-7000 series are exact duplicates of original equipment inserts. A few of them for special replacement uses are even higher in quality than the original equipment.

(Use Reply Card for Further Information)

Service Tags

The SN11 Service Tags, made by the Elbi Printing Co., consist of disposable number cards, each set consisting of 1000 numbers (00-999) conveniently padded consecutively in pads of 100. Cards are 5¼ by 7 in., perforated into three sections, the largest for attaching to the car; the other two make up a key tag and customer claim check. The number

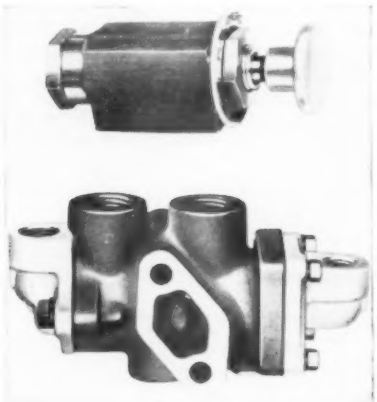
hangs from the rear view mirror of the car, the large black numbers on the yellow card being a fast, positive identification.

There is no chance of two cars with the same number being in the shop at the same time and there's no chance of getting numbers mixed. The cards are designed to eliminate time-wasting use of license numbers or other descriptions, and when the customer calls in for a progress report on the car, he need give only the claim check number—the name, make, model, color of car and so on, being unnecessary. SN11 Service Tags are said to give the customer a feeling of security with a realization that by having a definite number his car will be processed in turn rather than at the discretion of the foreman or service order writer.

(Use Reply Card for Further Information)

Air Brake Protection Valves

A newly designed emergency air brake valve for mounting in the tractor cab to provide "push-pull" manual control for isolating tractor braking pressure and to trigger the trailer brakes in the event of an emergency,



is announced by the Automotive Division of Wagner Electric Corp.

Also announced is an air line protection valve, used in combination with the manual control, and installed into service and emergency air lines leading to the trailer, replacing individual hand-operated shutoff cocks. In the event of a pressure loss on the trailer or a breakaway, it automatically isolates the tractor air supply, allowing normal control of tractor brakes.

Emergency braking may be triggered at any time by pulling the emergency brake valve knob; however, the automatic tractor air line protection unit requires no special action on the part of the driver in emergency due to trailer breakaway or loss of air pressure. Should the driver fail to use the manually operated emergency brake knob, the air line protection valve automatically reacts to seal tractor air lines and start trailer emergency braking as control line pressure drops to approximately 40-30 p.s.i. Normal operation resumes when tractor and reservoir pressure is restored to between 45 and 65 p.s.i.

(Use Reply Card for Further Information)

Platinum Tipped Spark Plug

An all-new "thermostatic" spark plug with exclusive, extra-long life platinum tip is being manufactured by Bowers Battery & Spark Plug Co. Called the "hottest plug in town and coolest on the road," the new plug has a projecting insulator tip to give maximum engine performance, with gasoline saving, at traffic jam pace or open highway speeds.

It also features a platinum plated center electrode which is said to be unaffected by the highest temperatures engine cylinders can produce . . . and is impervious to electrical erosion, said to cause 65% of all spark plug failures.

To provide perfect electrical contact between top and bottom portions of the center electrode, the new plug employs a conductive glass seal. A new 95% pure alumina oxide insulator whch is said to be approximately as hard as a sapphire jewel, permits the plugs to withstand the strongest shocks and bumps as well as the hottest possible engine temperatures.

An extra-heavy duty side electrode, a special, high conductor terminal cap which eliminates high voltage loss at the terminal, and a special analysis steel shell are also exclusive features of the new plug.

(Use Reply Card for Further Information)

Brake-Cyl-Lube

Brake-Cyl-Lube, recently announced by Tru-Torque, Otto-Items, Inc., is a lubricant and rust inhibitor for use in wheel cylinders to insure smooth, easy cup movement, and protecting the ends of cylinders from rust and corrosion when boots are not tight enough to prevent moisture from entering the ends of cylinders.

(Use Reply Card for Further Information)

Hex Wrench Set

A new set of short stroke, reversible ratchet box wrenches available with 10 popular size hex openings (from

1/4" to 7/8") is announced by the K-D Mfg. Co.

Each wrench is made with two popular size combinations: 1/4" and 5/16" (length 3 7/8"); 3/8" and 7/16" (length 4 1/4"); 1/2" and 9/16" (length 6 1/2"); 5/8" and 3/4" (length 7 7/8"); 11/16" and 7/8" (length 9-3/16").

(Use Reply Card for Further Information)

Vacuum Cleaner—Blow Gun

A hand-size, 2 1/2" lb., combination vacuum cleaner-blow gun is announced by Big Four Industries. Operating with full venturi action off the shop's air compressor, there is no motor or suction hose—the dirt is

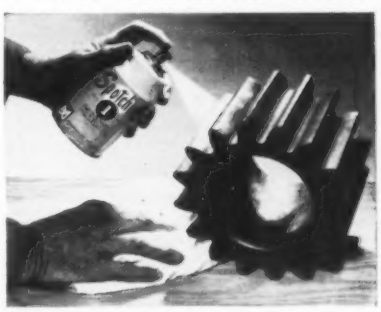
blown directly into a bag attached to the cleaner.

According to the manufacturer, the power suction provided quickly cleans up dirt from floor mats and upholstery. A push of a button changes the vacuum to blower action for dislodging dirt from under pedals, seats, and other hard-to-reach places.

(Use Reply Card for Further Information)

Dye Penetrant Inspection

Magnaflux Corp. has announced an important safety improvement in its Spotcheck dye penetrant inspection materials, which are now available



in nonflammable or very-high-flash-point formulas in either pressure-spray cans or in bulk.

The new Spotcheck, which provides a convenient spray-can dye inspection method for locating cracks, seams, porosity and other defects open to the surface in almost any solid material, is also nontoxic, although the manufacturer does advise use in reasonably ventilated areas. Cleaners and developers are not made with carbon tetrachloride-base solvents, but with the safer chlorinated hydro-carbons. Oil base penetrants have chlorine-free formulations. They can be used to test automotive parts almost anywhere in the shop or in the field, and under conditions that previously could have been considered as fire hazard.

(Use Reply Card for Further Information)

These are new *manufacturers' products*

Portable Bench

Anderson Mfg. Co. announces the Port-a-Bench, which they state is not an ordinary step stool, but a bench designed primarily for use where

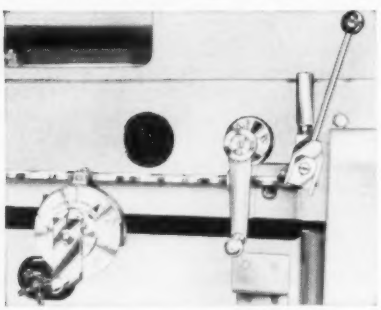
safety is of the utmost importance—especially for mechanics working on truck engines.

The unit, made of 13 gauge riveted steel construction, has rubber covered, non-slip feet, and is 20" high, with ¾" thick plywood steps which are 24" x 8". Special folding mechanism permits one hand operation plus compact silhouette when folded (it stands by itself).

(Use Reply Card for Further Information)

Cycl-o-matic Grinding

A new Cycl-o-matic control is announced by Van Norman Automotive Equipment Co. for use on their line of wet surface grinders so as to enable



the operator to set the dial for the required amount of material to be removed, start the machine, and walk away.

Principal features of this Cycl-o-matic operation are automatic material removal up to 50 thousandths with only one dial setting; automatic reversing at end of each traverse; and automatic feed shut-off according to pre-set requirements.

(Use Reply Card for Further Information)

Carburetor Gauge Sets

A full line of carburetor gauge sets is announced by Kent-Moore Organization, Inc., with which it is said to make possible any of the various adjustments needed on carburetors used on G.M., Studebaker-Packard and

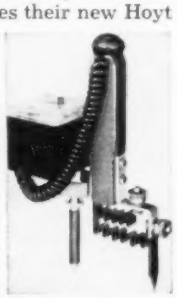
American Motors cars. There is a separate set for models of Rochester, Stromberg and Carter carburetors—two-or four-barrel models, dual or triple types.

Each gauge set is strung on a handy, quickly-identified bead chain in the order recommended for instant use. Instead of a series of various gauges likely to be mislaid or gotten out of sequence, the gauges are held together for easy use. Each set is designed to follow the manufacturer's service manuals and reference sheets for factory-perfect tune-ups.

(Use Reply Card for Further Information)

"Piggy-Back" Battery Tester

According to Burton-Rogers Co., anyone can observe battery condition when a mechanic uses their new Hoyt Model #700 "Piggy-Back" Battery Tester.



According to them, the mechanic can put the easily removable meter, which is attached to the tester prods with a coiled cord, right in the hands of a person standing alongside the vehicle and actually show him the condition of the battery.

Featuring an adjustable pointer that remains at the first cell reading as a "built-in memory" for comparison with other cell readings, the company states the tester indicates a questionable battery if more than a 5 division variation is apparent.

The high accuracy meter, with its four-color expanded scale, is stated to have a shatterproof, water-repellent face and reads to 1/100th of a volt during load and open circuit tests on all 12- and 6-volt batteries. Pointed prods adjust fully to fit all cell straps.

(Use Reply Card for Further Information)

Electronic Fuel Alarm

To lessen the possibility of running out of gas, an electronic fuel alarm that audibly warns the driver when his gas runs low is being offered by the Gas Chek Division of the Willor Mfg. Corp.

Called the "Gas Chek," the unit is self-contained in a baked-enamel finished aluminum box 4½" x 3" x 1¾",

which can be mounted behind the dash or elsewhere in the car. One wire from the unit is connected to the ignition switch terminal, the other to the fuel gauge.

When gas in the car's tank gets down to about three gallons, Gas Chek's buzzer starts to sound and gets louder as more gas is used—and it keeps on buzzing until more gas is put in the tank to bring it back at least to the three gallon level.

According to the manufacturer, the unit also helps prevent mechanical troubles that develop when sludge from the bottom of a near-empty gas tank clogs the fuel line, pump, or carburetor.

The unit works in any position, even upside down, whether or not the car's regular gas gauge is indicating—and it uses current only when it buzzes.

(Use Reply Card for Further Information)

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Automotive Service Digest

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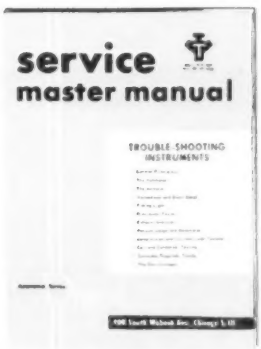
No. 1. Brake Systems

No. 1. BRAKE SYSTEMS. The complete step-by-step service story of brakes through conventional, vacuum-power, air hydraulic, and straight air types. It gives you a thorough knowledge of what brakes are and how, and why they work.



No. 2. Trouble-Shooting Instruments

No. 2. TROUBLE-SHOOTING INSTRUMENTS. Covering all important instruments, including oscilloscopes, used in connection with testing, diagnosis and tune-up operations. Each instrument is thoroughly covered individually to show how it works . . . how it is connected to get different readings . . . how these readings should be used . . . plus specific examples of problem solving.

No. 3. Ignition System Servicing

No. 3. IGNITION SYSTEM SERVICING. Explains the basic principles, theory and application of the primary and secondary circuits, breaker point and distributor operation, testing and servicing. Covers the function of the generator, coil, condenser and how they are related in the ignition system from battery to spark plugs. Detailed tuning and adjusting principles and service of magnetos.

No. 4. Servicing Automatic Transmissions

No. 4. SERVICING AUTOMATIC TRANSMISSIONS. The basic principles of operation . . . fluid couplings . . . torque converters . . . servo mechanisms . . planetary gears . . . throttle linkage adjustments . . . in-the-car service testing and corrections . . . band adjusting procedure. Covers the operation and service of Hydra-Matic, Powerglide, Fordomatic, Powerflite, Dynaflow, Powermatic and Flash-O-Matic.

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WHEEL SERVICES . . . New 20-page bulletin shows how the complete Bear equipment line makes it possible for any serviceman, large or small, to obtain at a price he can afford the needed starting equipment to get into big profit wheel service. Bulletin contains illustrations and descriptions of the company's Telaliner; 12 other alinement and frame straightening services; low cost gauge sets for the small shop; many special gauges and tools, and other needed equipment.

Write to: Bear Mfg. Co., Dept. ASD, Rock Island, Ill.

CARBURETOR HANDBOOK . . . This pocket-size 46-page "Know Your Carburetor" handbook describes in nontechnical terms the basic functions of an automotive carburetor, its various parts, and outlines common carburetor troubles with tips on how to correct them. The importance of carburetor care and regular "on-the-engine" cleaning are emphasized.

For your copy, write to: Pennsylvania Refining Co., Dept. ASD, 2785 Lisbon Rd., Cleveland 4, Ohio.

HOSE CLAMPS . . . Two new pieces of literature illustrate and give size diameters on company's complete line of adjustable hose clamps.

Write to: Wittek Mfg. Co., Dept. ASD, 4305 W. 24th Place, Chicago 23, Ill.

CLEANING BRUSHES . . . Booklet illustrates and describes the various kinds of bristles, hair and fibres used in the manufacture of floor and sanitary cleaning brushes, and is designed as an aid to selecting the right brush or mop for the various types of floors and applications found in the repair shop.

Write to: Flour City Brush Co., Dept. ASD, 1501 Fourth Ave., South, Minneapolis, Minn.

DOOR REPAIR PANELS . . . Latest catalog gives up-to-date listing of 1958 E-Zee-On door repair panels, including 1957-'58 Ford and '57 Chevrolet door repair panels. Selection of the correct panel is quickly and easily accomplished because of the alphabetical arrangement by car name.

Write to: Graver Industries, Inc., Dept. ASD, P.O. Box 4027, Cleveland 23, Ohio.

TIRE-TUBE REPAIRING . . . 3-page folder illustrates and describes each of company's three kits which offer assortments for tubeless tire and tube repair, for larger tube repair only, or a combination assortment. Also shown is the self-curing chemical fluid and the combination scraping-stitching tool which are included free with each kit. Of particular interest are the four simple steps required for patch use. These steps are illustrated and described in a manner that allows them to be used for a wall or reference chart.

Write to: Dill Mfg. Co., Dept. ASD, 700 E. 82nd St., Cleveland 3, Ohio.

TRUCK BRAKE LINING . . . This 40-page brake lining specification and descriptive catalog covers all makes and models of light and medium trucks, including 1958 models. Aside from specification material, the catalog also contains a brake lining group listing and a descriptive section. The group listing shows all Raybestos PGT brake lining sets listed numerically along with application data for each set. The descriptive section contains valuable information on the company's PGT sets, bonded brake shoes, RS molded segments, and combination molded and molded-woven brake blocks.

Write to: Raybestos Div., Raybestos-Manhattan, Inc., P.O. Box 1021, Dept. ASD, Bridgeport 2, Conn.

JACK REPAIR KITS . . . A new illustrated folder is now being offered on "Repair-it-yourself" hydraulic jack repair kits.

For your free copy, write: Jack-Pack Mfg. Co., Dept. ASD, 2115 N. Marianna Ave., Los Angeles 32, Calif.

LIFTING FOREIGN CARS . . . Based upon actual lifting tests performed in the Globe laboratory, this 24-page manual contains easy-to-follow instructions for spotting and positioning bantam size and sports model foreign cars on the H-shaped superstructures of frame-engaging lifts. Photos show vehicle approaching the hoist, with hoist adapters swiveled to proper contact position, and also the vehicle after it has been lifted. Diagrams illustrate wheel-spotting for quick, easy handling.

Write to: Globe Hoist Co., Dept. ASD, E. Mermaid Lane at Queen St., Philadelphia 18, Pa.

BRAKE SERVICE . . . Now available is a 30-page booklet on "Modern Brake" data for latest fundamentals, operating principals and adjustments for all makes of cars, including the new '58 models. Chapters of the handbook are devoted to drum scoring, good shop practice, important notes on bonding, brake lining wear and the grinding of bonded brake shoes. Also covered are causes of brake trouble and suggestions for rendering complete brake service.

Write to: The Russell Mfg. Co., Dept. ASD, Middletown, Conn.

BUSINESS FORMS, SYSTEMS . . . Here is a catalog which illustrates and describes the various types of stock forms available and how they can be used to greatest advantage for the efficient, systematic and profitable control of any business. Sections of illustrated

"Remind him that we want those brakes adjusted for the light, feminine touch!"

You may want this information and most of it comes to you free. Just write to the name which appears following the listing and your request will get prompt attention. To be sure of getting the item you want mention that it is the one listed in AUTOMOTIVE SERVICE DIGEST.

data show forms in general use covering all the basic functions of business —purchasing, receiving, payroll, accounting, invoicing, etc. In each case the forms are described and brief outlines of probable uses are given. Other sections are devoted to accounting aids, summary systems and a review of accessories. In addition, there is a section dealing with special forms not necessarily employed in systems. These would include such forms as are used for taking telephone calls, handling memos and other interoffice communications, etc.

Write to: The Standard Register Co., Dept. ASD, Dayton 1, Ohio.

VALVE SEAT INSERTS . . . Complete line of replacement inserts are listed in new catalog by year, model and make of car or truck. Numerical listing by part number gives the year, make and number of cylinders in the vehicle in which the part may be used, specifies intake or exhaust application (or both), gives outside and inside diameter, depth and counterbore size of insert, seat angle and number of parts per carton. Also contained in catalog is progressive size chart with oversizes indicated, a chart of decimal equivalents, detailed instructions for installation, a list of suggested counterbore cutters and an interchange list based on size.

Write to Aluminum Industries, Inc., 3670 Werck Rd., Dept. ASD, Cincinnati, Ohio.

TAPE DISPLAYS . . . "Sales You Make from these Displays Pay for the Tape You Use," is the subject of a four-page folder which describes how "double-duty" displays sell plastic electrical tape and friction tape to service shop customers and thereby pay for the tape the shop uses. Shown are many applications which illustrate these tapes in action, servicing the needs of automotive repair shops.

Write to: Dutch Brand Div., Johns-Manville, Dept. ASD, 7800 S. Woodlawn Ave., Chicago 18, Ill.

TURN SIGNAL FLASHER . . . Four-page bulletin contains advantages, specifications and installation instructions for a new line of sixteen automotive turn signal flashers. Has application data and charts to permit fast, easy selection of the right model for all passenger cars and most commercial vehicles.

Write to: Qualectric Corp., 990 East 67th St., Dept. ASD, Cleveland 3, Ohio.

BRAKE SHOE CATALOG . . . contains complete listings of bonded brake shoe sets for trucks and farm tractors, as well as passenger cars and features a handy chart on interchangeable brake shoes. Designed to make choosing the correct brake shoes as simple as possible, the new catalog contains 42 clear illustrations of various shoes to make identification quick and easy. Listings are numerical and alphabetical to increase speed and accuracy of identification.

Write to: National Brake Block Corp., 37-37 57th St., Woodside 77, N. Y.

To make your shop more profitable . . . your time more valuable . . . be sure to read this month's "These Are New" section

Calendar of Automotive Events

1958

Aug. 13-17—"Rod & Custom World's Fair" Auto Show, Eastern States Exposition Fairgrounds, West Springfield, Mass.

August 27-30—Automotive Parts Rebuilders Assn., National Convention and Trade Show, Conrad Hilton Hotel, Chicago, Ill.

Oct. 15-18—National Glass Dealers Assn., 1958 Convention, Americana Hotel, Miami Beach, Fla.

Nov. 3-6—Automotive Warehouse Distributors Assn., Inc., National Convention, Muehlebach Hotel, Kansas City, Mo.

1959

Jan. 17-25—Chicago Automobile Show, International Amphitheatre, Chicago, Ill.

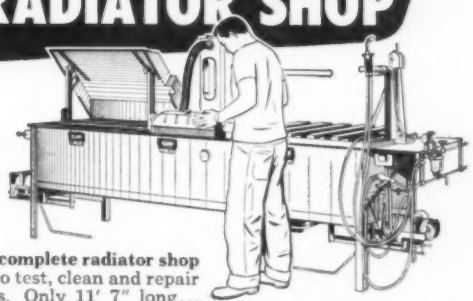
Jan. 31-Feb. 4—National Automobile Dealers Assn. Convention and Equipment Exhibition, Conrad-Hilton Hotel, Chicago, Ill.

Feb. 15-17—Automotive Affiliated Representatives Meetings, Pick-Congress Hotel, Chicago, Ill.

Feb. 18-21—Automotive Service Industries Show, Navy Pier, Chicago, Ill.

March 12-15—Pacific Automotive Show, New Brooks Hall, San Francisco Civic Auditorium, San Francisco, Calif.

NEW! INLAND 1-Piece RADIATOR SHOP



Now—a **complete radiator shop** ...easy to test, clean and repair radiators. Only 11' 7" long... handles all car radiators, many truck and tractor radiators.

FREE FACTORY SCHOOL will train one of your men...and in only a part of his time he will produce nice additional profits. Many adding $8,000-$15,000 a year servicing radiators.

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Are you now operating a radiator Dept.? ☐ Yes ☐ No

Some Tips on Cleaning Stainless Steel Trim

• WITH THE INCREASED use of stainless steel in wheel discs, grilles, body moulding and accessories on today's automobile, here are some "do's and don'ts" on the proper methods of cleaning this metal to enhance and preserve its bright appearance, as recommended by Republic Steel Corp.

There's only one "don't" on the list—but it's an important point: **Don't use ordinary steel wool** to clean stainless steel. If you've ever had a customer complain that his stainless steel wheel discs were "rusting," you've discovered the reason for this advice.

Actually, the steel men point out, stainless steel used in car trim does not rust. But when it is cleaned with ordinary steel wool, here's what happens: Tiny slivers of the steel wool pads break off as you rub the dirt spot. These work into your fingertips; they also become imbedded in the surface of the stainless steel.

The slivers do rust, and they produce the unexpected brown streaks that discolor the surface of the stainless steel.

How to prevent this unhappy outcome? When stainless steel needs scouring, use only stainless steel scouring pads, the same kind that are used

Stainless steel auto trim should first be cleaned with ordinary scouring powder . . . if necessary, use stainless steel scouring pads . . . then rinse with clear water and polish with a dry cloth or chamois. *Do not* use ordinary steel wool.

in the kitchen for cleaning stainless steel pots and pans. Even if slivers of these break off and become imbedded in the stainless steel surface, they won't rust and cause discoloration.

Use stainless steel pads also to remove the discoloration caused by rusting steel wool pads. Just scour over the spot, adding scouring powder occasionally, until the tell-tale scars no longer mar the stainless steel surface.

Other positive suggestions on cleaning stainless steel trim include:

DO clean stainless steel in most cases like you clean the rest of the car; soapy warm water with a clear water rinse.

DO use scouring powder—the ordinary household kind—to clean caked-on dirt and stubborn grease spots before resorting to the stainless steel scouring pad.

DO rub on the scouring powder in the direction of the polish lines, "with the grain" of the metal. This prevents scratching and helps preserve the high surface finish.

DO wipe the stainless steel dry with a soft cloth or chamois. This prevents streaks from soap residue or minerals in the water that appear when the rinse water is left to dry by air.

DO rely on the natural ability of the stainless steel to keep its bright appearance. It needs no polishes, lacquers or other coatings once it is clean.

CLEANING PARTS
WITH INFLAMMABLE LIQUIDS
CAN CAUSE DISASTROUS FIRES!
DANGER
DANGER
Kleerflo
is the
SAFE
AND SANE WAY
TO CLEAN
Automotive and
Industrial Parts
SOLVE YOUR SAFETY PROBLEM
WITH KLEER-FLO EQUIPMENT
& HIGH FLASH POINTS SOLVENTS
Kleer-Flo
Model 30
(less Jet
Air Gun)
also
available
Kleerflo
SUPER
CLEANMASTER
MODEL 50
CLEAN PARTS
3 WAYS-SAFELY!
1. Continuous Flow Hose
2. Air Agitated Soaking Tank
3. "Super Power" Jet Air Gun
Rugged equipment that users enthusiastically say "pays for itself many times over in efficient time-saving, long trouble-free usage!" A continuous flow pump strains, filters and ejects abrasive foreign material and returns clean Kleer-Flo Hi T Degreasol or M-467 Cleaning Fluids through the semi-rigid hose to the upper soaking tank. Fire hazard is reduced by a quick action fusible link in self-closing cover.
Efficient patented electric pump is driven by a fan-cooled brushless, sparkless motor.
Adapted for Critical Cleaning
of Automatic Transmissions
and Power Steering Units
CALL, WIRE, WRITE TODAY FOR INFORMATION
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Leaves film
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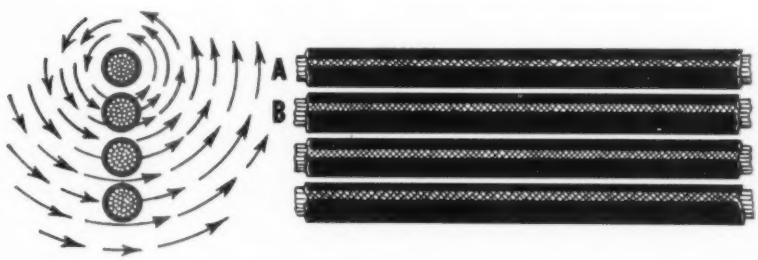
SAFE!
Fast drying—
leaves no
film

BRUSHING UP ON THOSE EASY-TO-FORGET THINGS

Refresher course

✔ *Cross fire ignition . . . what it means*

• A HIGH VOLTAGE impressed on a cable builds up a strong magnetic field around it (A). If a second cable (B) is placed parallel to the first cable and close enough to be in the latter's magnetic field, voltage is induced in the second cable even though there is no actual connection between the two.



Induction of voltage in spark plug cables, placed closely together can occur. But merely inducing voltage in a spark plug cable of a non-firing cylinder at that time usually causes no trouble.

Trouble can occur on V-8 engines where four of the cables are bunched coming from the distributor cap. Two cylinders on the same bank fire 90 deg. apart and induction may fire one of the cylinders 90 deg. ahead of its normal firing time, producing cross-firing ignition.

For example, with a firing order 1-8-4-3-6-5-7-2 where even numbers are in one bank and odd numbers in the other bank, cross firing can occur 90 deg. ahead of normal in cylinder 4 when 8 fires, or in 7 when 5 fires.

Spark plug cables on consecutively firing cylinders should, therefore, be as far apart as possible.

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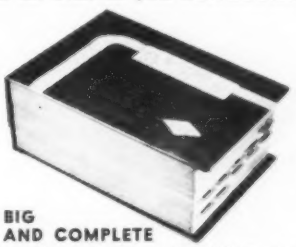

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Horsepower . . .

(Continued from page 32)

full throttle, but this may drop to 90% under low speed conditions.

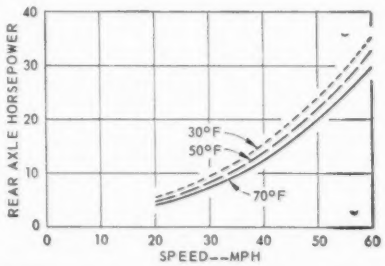
The wind and rolling resistance involves a number of variables, such as friction in the wheel bearings and seals, friction within the tire, friction of the tire-road contact, wind or air drag of the car body and chassis, and churning of the air by the wheels. In view of the many varying factors that affect the amount of power required to overcome rolling and wind resistance, it is impossible to give definite figures to cover it. However, a *range* of power requirements can be given. At normal driving speed of 60 m.p.h., the power ranges from 29 hp. to 49 hp. for our theoretical car. The wide range is due to differences in the assumed conditions of operation. A change in tires, a 40° difference in temperature, wet pavement, and 13 m.p.h. headwind will require the greater amount of power. Temperature has more effect on power requirement than is generally realized. Lower temperatures require more power, which is one of the reasons that we get fewer miles per gallon in cold weather.

Remember, all the figures and values given in this discussion apply to the assumed engine and car—which would be roughly equivalent to a V-8 Ford or Chevrolet. For larger and heavier cars the power requirements increase in approximate proportion.

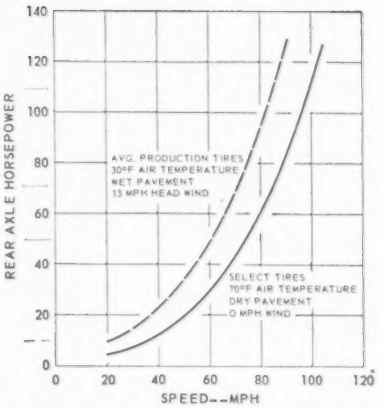
REQUIREMENTS MOUNT WITH SPEED

It becomes apparent that most of the power requirements mount with increases in speed, which accounts for greater fuel consumption when the car is operated in the higher speed ranges.

We have spoken of "power losses"; but actually they are not losses. It is spending available energy to get the desired results in the way of comfortable, dependable and reasonably economical transportation. Of the original energy in the fuel the engine only converts 25% of it into mechanical energy. Due to the throttle control the amount of energy developed by the engine is exactly the amount needed to supply power requirements of the accessories, transmission, rear axle, and the rolling and wind resistance. Therefore, if a given vehicle speed requires a total of 75 hp., that is what the engine develops to maintain the speed on a level road. The difference between the power used under any set of conditions and the peak power is the power reserve which can be used and is available for acceleration, climbing hills, pulling heavy loads, or for meeting any other condition which needs more than the usual amount of power. With wide open throttle the engine will develop its maximum power output, but this may not amount to peak horsepower. Peak power is only developed when conditions permit the engine to operate at rated revolutions per minute.



Surprising as it may seem, there is quite a difference in power requirements to propel the car under varying temperature conditions.



Curves indicating the power needed to propel the car, which varies considerably with road, tire, temperature and wind conditions. The broken line shows that more power is required when conditions are less favorable.

ACKNOWLEDGEMENT: *Some of the material and most of the specific values used here were supplied by members of the Society of Automotive Engineers; Carl E. Burke and Larry H. Nagler, of American Motors Corp.; E. C. Campbell of General Motors Corp.; W. E. Zieren and H. I. Welch of Chrysler Corp.; T. D. Kosier and W. A. McConnel of Ford Motor Co., in a joint symposium presented to the Society. Graphs and diagrams are through the courtesy of the S.A.E.*

BULLETIN

Mr. Mechanic:
The owners of the following cars are having trouble with vapor lock, gasoline fumes and poor general performance during hot weather driving:
Ford - Mercury-Lincoln-Chevrolet - Oldsmobile-Chrysler
Here is the trouble maker:

The trouble fools many mechanics because it only occurs when the engine is a little overheated, such as -- in heavy traffic (Stop & Go), pulling a long hill, starting after brief stops (you know how the engine heat will raise when you first stop and the car is hard to start again immediately). Bear in mind, all these cars have nearly the exact same heat tube in the exhaust manifold to feed hot air to the automatic choke. The air passing through this original heat tube gets super hot and heats up the choke housing and adjacent carburetor body with extreme temperature, causing gasoline to boil, creating vapor lock and producing gasoline fumes. The BPS Choke Stove being mounted on the outside of manifold does not deliver this terrific hot air making for the above conditions, but it will supply just the right amount of air at correct temperature. The Choke Stove is guaranteed to perform to satisfaction or your money refunded.

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To make your shop more profitable . . . your time more valuable . . . be sure to read this month's "These Are New" section

A tubeless tire is only as good as its valve

By B. S. BYALL, Sales Manager
The Dill Manufacturing Co.

● FOR MOST SERVICE shop personnel, the need for replacing tubeless tires on passenger cars is clearly understood. A tire whose treads are worn smooth, or one that is damaged beyond safe repair is obviously destined for the scrap pile.

Not so clearly understood, however, are the when's and why's of replacing the valves in tubleless tires. And the lack of definite understanding of these problems is not only reducing replacement sales, but may even be the cause of serious accidents by car owners.

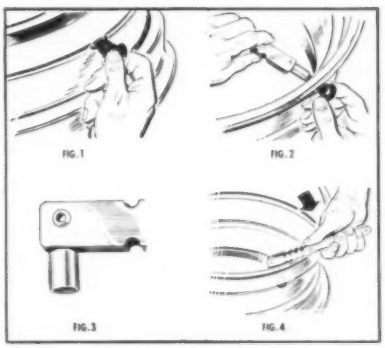
One thing must be remembered at the start: tubeless tire valves are designed and built to give long and trouble-free service under normal driving conditions, at least for the life of the tire.

Nevertheless, even under day-to-day driving, valves are subject to extremes of both heat and cold, plus the many external abuses of even the safest motoring.

Accordingly, as with any rubber product, their service life may be calculated, and when this life expectancy is reached, they obviously must be replaced for maximum safety and effectiveness.

Because of this, valve manufacturers strongly recommend that when tubeless tires are replaced, valves be replaced at the same time. This is true even though the valve may, from outward appearances, look to be in satisfactory condition. *Remember*: A valve cannot be inspected in the rim hole; and in removing it, the valve must be cut and thus destroyed. Therefore, for the safety of your customer, don't take chances—replace the valve with the tire.

While it is thus mandatory to replace a valve when a tire is replaced, it is just as important to check valves each time a tire is repaired to make sure it is performing properly. Obviously, leaks can occur around the valve base and in the rim hole section where they cannot be visually inspected. Therefore, the following steps should be taken.



1. Insert valve into rim hole, then . . . 2. Screw valve mouth into tool holder. 3. For long valves, have swivel head in short position; for short valves, reverse the tool. 4. Attach tool slot to edge of rim flange. Valve length determines the correct slot to use. Pull valve through hole carefully.

If the tire is flat when a customer brings it into the shop, inflate it with two to five pounds of air and apply a soapy solution around the valve base and hole. This will quickly show up any leakage; and a similar test on the core will disclose any escaping air at this point, too.

It is always best to check for possible valve stem leakage before the tire is repaired, rather than wait until it is remounted, only to discover the leak and have to remove the tire once again.

INSTALLING VALVES SIMPLE JOB

With the development of convenient installation tools, placing valves in rims and tires is a quick and simple job. As shown from the accompanying drawings, the valve is simply inserted into the rim hole; the valve mouth screwed into the special valve tool holder; the tool slot attached to the edge of the rim flange, and the valve pulled through.

* * *

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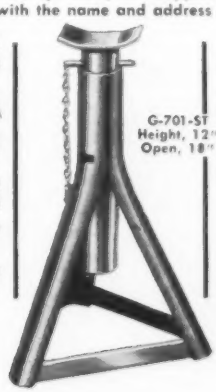

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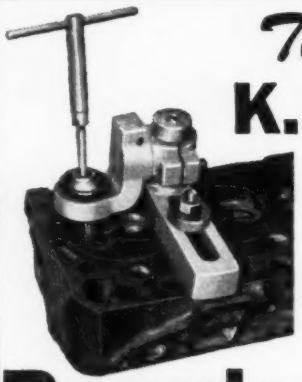

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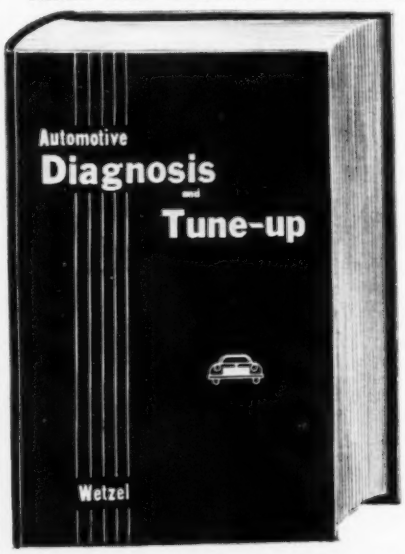

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The Flash-O-Matic . . . *(Continued from page 22)*

counterclockwise to decrease the pressure. After pressure is properly adjusted, tighten the unit locknut securely. If correct oil pressure adjustment cannot be obtained by rotating the control unit, check the vacuum connection between the unit and the carburetor. Transmission vacuum in excess of 6½ inches at 1000 r.p.m. indicates an unbalanced vacuum source from leaks, obstructions or carburetor vacuum calibration. Adjustment of the vacuum and control solenoid control unit has no effect on the transmission vacuum.

PERIODIC MAINTENANCE

Transmission fluid should be checked every 1000 miles, or whenever the car is lubricated. Check fluid with engine operating at idle speed, fluid warmed up to normal operating temperature, and transmission in neutral. While waiting for the transmission fluid to normalize, run the transmission through the complete gear selector range. With transmission prepared for a fluid check in the above manner, fluid should read on the F mark on the dipstick. If low, enough automatic transmission fluid (type A) should be added to bring level within specifications. To raise the level from the L mark to the F mark on the dipstick takes about 1½ pints of fluid.

The transmission should be drained and refilled with fresh fluid every 15,000 miles. The fluid must be drained from both the transmission *and* the converter. Draining should be performed while the fluid is still warm. When draining the converter, remove both drain plugs to make sure all fluid is drained. Also remove the transmission case oil filler tube located on right hand side of oil pan.

To refill, pour in about 5 quarts of recommended fluid. Start engine and run it for several minutes with the N button pushed in. Then add approximately 3½ additional quarts to bring the fluid up to the F mark on the dipstick. Run transmission with push buttons in all gear positions, and recheck level. *Do not overfill* the transmission as this will cause foaming.

Flash-O-Matic transmissions are neat, compact units and are capable of delivering many miles of dependable service. A general working knowledge of transmission operation, maintenance and adjustments will place the general repair mechanic in a position to give the owners of American Motors cars valuable, dependable service.

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HE WHO LAUGHS, COME WHAT MAY,

WILL LIVE TO LAUGH ANOTHER DAY

Short circuit smiles

A Dean of Women, addressing the student body of a large co-educational college, began as follows: "The president of the college and I have decided to stop all necking on the campus."

Met by a gale of laughter, she became flustered but managed to continue. "Furthermore," she added, "all the kissing that has been going on under my nose must be stopped."

★ ★ ★

The big-game hunter was captured by jungle headhunters who made a practice of shrinking and preserving their victim's heads. He was thought to be lost forever, but 2 years later he phoned his wife from a jungle outpost, saying he had escaped from the headhunters.

"I need clothing," he told his wife over the phone. "The headhunters fed me, but my clothing is completely gone. Send me some shirts, size 16 and a suit, size 38."

"Anything else?" asked the wife, happy that her husband was safe.

"Oh, yes," said the husband, "a hat—size one."

★ ★ ★

1st Carpenter: "What makes you think your wife is getting tired of you?"

2nd Carpenter: "Every day this week she's wrapped my lunch in a road map."

★ ★ ★

A retired Wisconsin farmer, on a tour of the country, stopped in Las Vegas and decided he would just once try his luck at the dice table. His opponent, a shrewd-looker, picked up the dice. As he rolled, out popped a third cube from inside his sleeve. Unruffled, the farmer picked up the dice, pocketed one of them and handed back the other two. His only words were: "Okay, roll. Your point is 18."

★ ★ ★

Did you ever wonder where mothers learn all the things they tell their daughters not to do.

Joe—"I hear Sandy McTavish has bought the gasoline station down at the corner."

Moe—"Well, I don't know for sure, but somebody bought it, and the 'free air' sign came down yesterday."

★ ★ ★

A girl bought a ticket in a big lottery and insisted on number 51. It turned out to be the winning number and she received $15,000.

A reporter calling on her asked: "What made you pick 51?" "Well," she said, "for seven nights I dreamed of number seven, and seven times seven is 51, so I bought the ticket."

★ ★ ★

"Oh, my poor man," exclaimed the kind old lady. "It must be terrible to be lame. But it would be much worse if you were blind."

"You're absolutely right, lady," said the beggar. "When I was blind people kept giving me phony coins."

"I distinctly remember ordering you to build a 'motor' pool, sergeant, not a . . ."

A drunk, traveling aboard an ocean liner headed for Europe, staggered from the deck to the stateroom, sat down and peered through a porthole the entire afternoon.

Finally he got up, turned his back and mumbled, "What a lousy television show."

★ ★ ★

It takes all kinds of people to make a world, including the young man who was in the habit of standing in front of City Hall and snapping his fingers.

When asked what he was doing, he answered, "Can't you tell? I'm keeping the elephants away."

"Elephants!" said the inquirer. "Why there isn't an elephant within miles of here."

"I know, I know," replied the young man proudly. "Effective, isn't it?"

★ ★ ★

First salesman—"What kind of oil do you use in your car?"

Second ditto—"Well, I usually begin by telling 'em I'm lonely."

★ ★ ★

Wife, reading husband's fortune from a penny scale: "You are a leader of men, have a magnetic personality and are of strong character. You are intelligent, witty and attractive to the opposite sex . . . It has your weight wrong, too."

★ ★ ★

"Well, I guess I might as well put the motion before the house," said the chorus girl as she danced out onto the stage.

★ ★ ★

Optimist: *A guy who marries at the age of 89 and starts looking for a house near a school.*

★ ★ ★

"Dad, I'm in love with a girl."

"Son, you couldn't have made a better choice."

★ ★ ★

Reporter—"The name of that man on the west side who was struck by lightning is Brzinslatowskiwicz."

City Editor—"What was his name before he was struck by lightning?"

★ ★ ★

Little boy in woodshed: "Father, did grandpa spank you when you were a little boy?"

Father (with paddle): "Yes, my son."

Little Boy: "And did great-grandpa spank grandpa when he was a little boy?"

Father: "Yes."

Little Boy: "Well, don't you think with my help you could overcome this inherited rowdyism?"

★ ★ ★

Said one lightning bug to another: "Gimme a push; my battery's dead."

★ ★ ★

Someone once remarked to Will Rogers that Webster spoke perfect English.

"Shucks," snorted Rogers in his own inimitable way, "if I wrote my own dictionary, so could I."

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